

REVISION OF *DEMONAX* KINBERG, *HYPSICOMUS*
GRUBE, AND *NOTAULAX* TAUBER, WITH A REVIEW OF
MEGALOMMA JOHANSSON FROM FLORIDA
(POLYCHAETA: SABELLIDAE)

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Abstract.—A study to clarify the systematics of some Sabellinae was conducted. The systematic importance of setae, uncini and the branchial crown of the subfamily are discussed. *Demonax* Kinberg, *Parasabella* Bush, and *Distyliidia* Hartman are synonyms. *Demonax lacunosus*, n. sp., is described from Florida, and *D. microphthalmus* (Verrill), *D. rugosus* (Moore), *D. pallidus* (Moore), and *D. japonicus* (Moore) are new combinations; a key for 9 American *Demonax* species is provided. *Hypsicomus* Grube is redefined based on examination of the type-species, *Sabella stichophthalmos* Grube, which is redescribed. Other species previously included in *Hypsicomus*, except *Anamobaea orstedii* Krøyer and *Hypsicomus caecus* Iroso, are transferred to *Notaulax* Tauber with type-species *N. rectangulata* Levinsen. *Notaulax bahamensis*, n. sp., and *N. paucoculata*, n. sp., are described from the Bahamas. *Sabella brevicollaris* Grube, *S. torquata* Grube, and *Protulides elegans* Webster are synonyms of *Notaulax nudicollis* (Krøyer). *Parasabella sulfurea* Treadwell, *Sabella alba* Treadwell, and *Hypsicomus purpureus* Treadwell are synonyms of *Notaulax occidentalis* (Baird), new combination. *Notaulax californica* (Treadwell) and *N. midoculi* (Hoagland), new combinations, are redescribed. Twelve additional taxa in *Notaulax*, some of which are indeterminable or are synonyms, are listed; a key for 10 *Notaulax* species is provided. *Megalomma bioculatum* (Ehlers) and *M. lobiferum* (Ehlers) are redescribed; *M. pigmentum* Reish is newly reported from western Atlantic waters and additionally described; and *M. heterops*, n. sp., is described from Florida.

This paper is the fourth of a series of systematic papers on polychaetes (Perkins 1979, 1980, 1981) based for the most part on specimens collected between September 1971 and July 1973 in an environmental baseline study of marine biota near the Florida Power and Light Company nuclear generating plant at Hutchinson Island, St. Lucie County, Florida. Polychaetes proved to be a dominant and diverse group. However, there were many systematic problems with animals collected during the study, and a long-term project evolved in an attempt to solve some of them. The filter feeding subfamily Sabellinae, although not as important on soft bottom habitats as on hard bottom ones, nevertheless required an extensive systematic study. Numerous other specimens from Florida, the Caribbean Sea, and worldwide localities were examined to clarify generic and specific problems, resulting in the need to revise three genera and describe several new species.

The Hutchinson Island study area and methods and materials were described by Gallagher and Hollinger (1977). Sediments were described by Gallagher (1977), and other aspects of the physical and chemical environment were reported by

Worth and Hollinger (1977). Brief descriptions of sampling stations and methods were also given by Perkins (1979).

In addition to specimens deposited in the Invertebrate Collection of the Florida Department of Natural Resources Marine Research Laboratories (FSBC I), specimens were borrowed from or deposited in the following museums: American Museum of Natural History (AMNH), through H. S. Feinberg; Academy of Natural Sciences, Philadelphia (ANSP), through Tran-ngoc Loi; British Columbia Provincial Museum, Victoria, B.C., Canada (BCPM), through P. Lambert; British Museum (Natural History) (BMNH), through A. I. Muir; Indian River Coastal Zone Museum, Fort Pierce, Florida (IRCZM), through J. E. Miller; Museum of Comparative Zoology, Harvard University (MCZ), through H. W. Levi; Naturhistoriska Riksmuseet, Stockholm (NRS), through R. Oleröd; Invertebrate Museum, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami, Florida (UMML), through G. L. Voss; U.S. National Museum of Natural History, Smithsonian Institution (USNM), through K. Fauchald and M. H. Pettibone, including some specimens collected by the U.S. Fish Commission (USFC); Peabody Museum of Natural History, Yale University (YPM), through W. D. Hartman; Zoologisches Museum für Naturkunde der Humboldt-Universität zu Berlin (ZMB), through G. Hartwich; Zoologisk Museum, Copenhagen (ZMC), through M. E. Petersen; and Zoologisches Institut und Zoologisches Museum, Hamburg (ZMH), through G. Hartmann-Schröder. Additional specimens were donated by T. Cuba, University of South Florida, St. Petersburg; R. G. Ernest, Applied Biology, Inc., Jensen Beach, Florida; T. S. Hopkins, Dauphin Island Sea Lab, Dauphin Island, Alabama; Joan Uebelacker, Dauphin Island Sea Lab and Barry Vittor & Associates, Mobile, Alabama; and R. W. Virnstein and J. K. Reed, Harbor Branch Foundation, Inc., Fort Pierce, Florida. Some specimens donated by J. K. Reed were collected by *Johnson-Sea-Link* submersibles I and II (JSL); the dive number follows the submersible designation in the material examined.

M. E. Petersen (ZMC), M. H. Pettibone (USNM), K. Fauchald (USNM) and P. Knight-Jones, University College of Swansea, Wales, U.K., provided information and copies of papers not available to me. E. W. Truby, Florida Department of Natural Resources, sectioned setae and helped with photography. W. G. Lyons, R. O. Reese, R. H. McMichael, Jr., M. J. Durako, and K. Fauchald critically read the manuscript and suggested important changes. Many individuals from the Florida Department of Natural Resources Bureau of Marine Research and from Applied Biology, Inc., participated in the Hutchinson Island study, for which Florida Power and Light Co., provided partial funding.

Abbreviations used on figures to indicate parts of the branchial crown and anterior end are as follows:

- d1 dorsal lip
- vl ventral lip
- ra radiolar appendage
- pa pinnular appendage
- vs ventral sac
- pl parallel lamella
- al aricular lamella
- ppl prostomial-peristomial lamella

pm palmate membrane region
bl basal lamina
fr radiolar flange
fb basal flange

Sabellinae Rioja, 1923

Figs. 1, 2

Setae and uncini.—The various shapes of setae and uncini have often been misinterpreted using light microscopy, and the importance of some characters has been overlooked by some authors, including myself. The following is an explanation of some forms of setae and uncini and their systematic importance, especially at the generic level.

Avicular hooks, shaped somewhat like a swan or a "Z," have a large, pointed main tooth, fang or beak surmounted by a crest with a large number of small teeth. Below the crest, hooks are bent at greater than 90°, forming a moderately long neck and rounded breast, then bent in the opposite direction from the beak at about 90°, forming the handle or manubrium. Small teeth of the crest are often not resolvable with light microscopy unless the hook has been crushed. More than moderate intraspecific differences in avicular hooks are correlated with animal size, and only pronounced differences in them are important. They usually have short handles when not accompanied by companion setae, as in *Branchiomma* K  lliker, 1858. When accompanied by companion setae, handles may be moderately long to long, as in *Demonax* Kinberg, 1867, and *Megalomma* Johansson, 1927, or very long, as in *Potamethus* Chamberlin, 1919.

Companion setae (Fauchald 1977a:135, 156), found in tori in an adjacent row anterior to thoracic avicular hooks of most genera, are formed of an embedded shaft aligned in the same direction as handles of avicular hooks. The core apparently ends abruptly at the end of the shaft just outside the body. The tip of a companion seta, which is bent at about a right angle more or less anteriorly or obliquely away from the avicular hooks, appears to be a continuation of the thin outer covering of the shaft and is usually teardrop shaped, pennonate, with the proximal part broader than the shaft. The tip somewhat resembles the blade or hooded region of a *broadly hooded seta*, described below, but is without the central core. In lateral view, emergent parts of companion setae are usually shaped somewhat like a foot with a rounded heel and pointed tip (Fig. 281).

Companion setae of *Demonax* (Figs. 5X; 8A, B) have similar shafts (they may have an indistinct breast), but cores are expanded as broad and avicular tips. They may have a crest of small teeth, visible using a light microscope, above a beak-like tip. A hyaline mucro extends from the center of the outer surface of the beak or from the penultimate tooth. Except for the mucro, these are similar in form to thoracic hooks of *Chone* Kr  yer, 1856 (Fabriciinae).

Setae, in contrast to uncini, are found only on the collar segment, notopodia of the thorax, and neuropodia of the abdomen, and thus it is not necessary to designate them as notosetae and neurosetae. They take various forms, from paleae in the lower group of thoracic setae of some genera, as in *Notaulax* Tauber, 1879, *Potamilla* Malmgren, 1866, and *Pseudopotamilla* Bush, 1905, to slender capillary setae in the abdomen of *Notaulax* and *Hypsicomus* Grube, 1870. However, except for the possible exception of capillary setae, most of the emergent parts of setae

of most, if not all, genera are hooded (K. Fauchald, pers. comm.). They are formed of a central core of fused rods surrounded for the most part by a region of irregular, lacunar spaces and an outer shell (Fig. 1A-E). The outer shell appears to be formed of loosely fused rods or plates (Knight-Jones 1981: figs. 46, 47, 51). Lacunar spaces are found on lateral, anterior, and posterior sides. Upper thoracic setae are slightly bent medially, and lower thoracic setae are usually more strongly bent medially in the direction opposite from the lacunate spaces. Tips of rods forming the outer shell may appear as spines on the surface. Embedded parts are similar in cross section to setae described by Orrhage (1971) in being formed of hollow rods. These rods appear to extend into the middle part of the central core of the emergent parts, where the hollow parts of the rods appear to be more filled in. These have been described as limbate setae by most authorities.

Paleate setae are very stout forms of the setae described above. Emergent parts are short, thick, somewhat inflexible, spoon-shaped, and strongly curved in cross section, with concave surfaces of thoracic ones facing medially (Knight-Jones 1981: figs. 48, 49). This type of seta is usually found in the lower thoracic group, but occurs on the abdomen of some genera. Paleate setae are usually mucronate but may not be so on the thorax of some *Notaulax* species; the central core appears to be very broad. Paleae on the thorax of *Notaulax* species are arranged in oblique rows; they are arranged in transverse rows on *Potamilla*, *Pseudopotamilla*, and most other genera.

Setae in the upper thoracic group, usually found in an arc above the notopodial papilla or lobe of most genera, are almost circular in cross section and slender; a transverse line, in reference to the body of the worm through a cross section of a seta, bisects the central core (Fig. 1A). Such setae in *Notaulax* are stout, spine-like, and longitudinally oval in cross section (Fig. 1D). Setae similar to upper thoracic setae almost always occur on the collar segment, and similar setae may be found in the abdomen. These setae are defined as *narrowly hooded setae* because of this shape and the arrangement of lacunate spaces.

Lower parts of notopodia of genera with transversely arranged groups of setae, of which paleae are a special form, usually have setae in which a line, longitudinal to the body of the worm, drawn through the greatest diameter of a cross section, does not bisect the longitudinally oval central core (Fig. 1C). Termed *broadly hooded setae*, these may be slender on some species but are broader than adjacent upper setae; when short and broad, they may approach the paleate condition noted above. This type of seta is found on *Demonax* and *Megalomma*, for example. Setae of the abdomen of the latter and some other genera may be intermediate between broadly and narrowly hooded setae.

Lower thoracic setae of *Sabella* Linné, 1767 (Fig. 1B), and *Branchiomma*, which in most cases are arranged in longitudinal or oblique groups, are stout, spine-like, and appear to be narrowly hooded in lateral view. They appear similar in form to upper thoracic setae found in those genera but are usually much stouter and transversely oval in cross section. However, in these setae, a transverse line drawn through the greatest diameter of a cross section bisects the transversely oval, central core. The exact orientation of the long axis of a cross section of these setae probably varies by as much as 45° from the transverse. These are defined as *spine-like setae*.

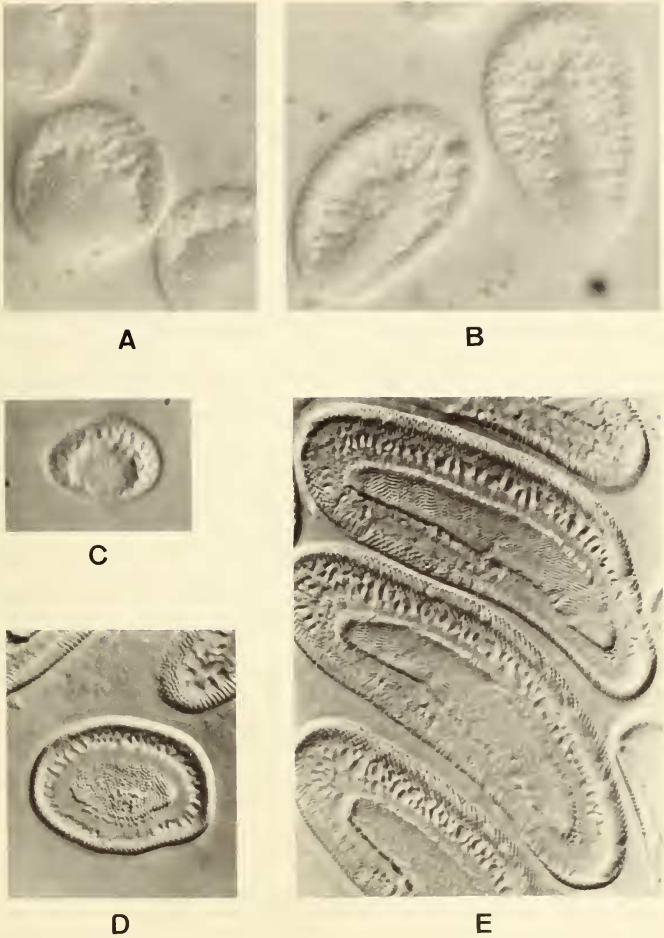


Fig. 1. A, Cross section of upper thoracic seta of *Sabella variegata* from Tampa Bay, Florida; B, Cross section of lower thoracic setae of same; C, Cross section of lower thoracic seta of *Demonax microphthalmus*; D, Cross section of upper thoracic seta of *Notaulax nudicollis*; E, Cross section of lower thoracic setae (paleae) of same (A, B, FSBC I 27682; C, FSBCI 14534; D, E, FSBC I 24006; not scaled).

Setae were embedded in Spurr's epoxy resin (Spurr 1969) used for transmission electron microscopy, cross sectioned with an ultramicrotome, dried on a microscope slide, and covered with a cover slip. Photographs were taken using Zeiss Nomarski interference-contrast optics.

The branchial crown.—The branchial crown is as important in the classification of Sabellidae as are the opercula in Serpulidae and Spirobridae. Its structure is emphasized here in addition to the arrangement and types of setae and uncini and other characters, especially in generic diagnoses. Anatomy, histology, and functions of the crown have been described in detail for *Sabella pavonina* Savigny, 1820, in a classical paper by Nicol (1931). Homologues of the parts of the crown of *Sabella penicillus* non Linné (= *S. pavonina*) and several other species have been discussed by Orrhage (1980). The fine structure of the junction between the branchial crown and body of *Sabella penicillus* non Linné (= *S. pavonina*) has been described by Kryvi (1975) and by Kennedy and Kryvi (1980), and fine structure of its endoskeletal cartilage has been described by Kryvi (1977).

The crown is composed of a fused, horsecollar-like base supported by a cartilaginous skeleton which is continuous dorsally but not ventrally. The base supports paired branchial lobes and the dorsal and ventral lips. Dorsal and ventral lips are inside the usually circularly arranged group of radioles. Branchial lobes can simply be spread apart to observe the dorsal and ventral lips in some cases; however, if sufficient specimens are available, it is better to remove one of the branchial lobes with associated lips and spread it out. This can be done by pressing a blunt dissecting needle on one side of the ventral margin at the junction of the branchial crown and body, described briefly below.

The endoskeleton of the base of the crown consists of a pair of short to long lateral bars or horns and a dorsal transverse bar. The transverse bar apparently functions as a fulcrum allowing opening and closing of the branchial crown. Lateral horns, from which develop skeletons of the radioles, are joined to longitudinal muscles of the body by interdigitating connective tissue of the cartilagenous matrix of the skeleton and the epimysium of the muscles. The connective tissue is held together by muscle cells with paramyosin filaments (Kryvi 1977). On *S. pavonina*, this junction was shown to function as an abscission zone by Kennedy and Kryvi (1980) and, although possibly not having identical function, was morphologically similar on several other sabellid species examined by them.

Dorsal lips (Figs. 1A, B, 7C, 15F), which function at least in some species to remove wastes, are for the most part arranged vertically. In some genera, e.g., *Megalomma*, they appear to be almost completely separated, while in others, e.g., *Sabella*, each half is joined to the other medially above the mouth (ventromedially) by a thin lamella (Orrhage 1980: fig. 1d; Fig. 2A). They may have two types of appendages (Orrhage 1980), those formed by a modified radiole which have lamellae on their upper and lower sides for part of their length, and those on the upper side joined to the upper lamella which are modified pinnules of the first dorsal radioles. The former are called *radiolar appendages* (Figs. 2A, 7C), and the latter are termed *pinnular appendages* (Figs. 2B, 7C) rather than simply "appendages of the dorsal lips" as defined by Orrhage (1980). Upper lamellae are fused with the base of the first dorsal radiole, with or without pinnule appendages (Figs. 2A, 7C, 23B, 43A). An example of a species having dorsal lips with only radiolar appendages is *Sabella pavonina* (Fig. 2A); a species with only pinnular

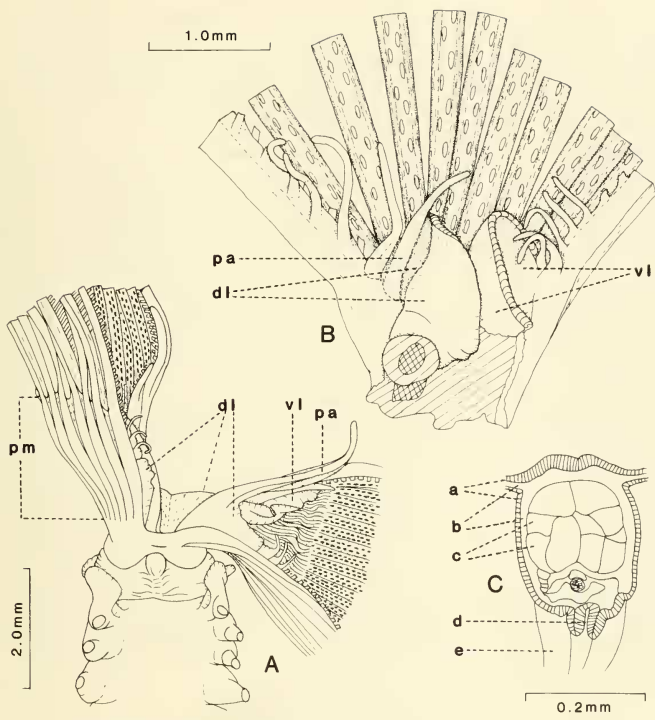


Fig. 2. A. Anterior end of body and proximal part of branchial crown of *Sabella pavonina* (River Roach, Essex, England; BMNH ZH 1865.6 22.2) B. Proximal part of left half of branchial crown of *Potamilla torelli* (Bay of Fundy; USNM 44756); C. Cross section of radiole in region of palmate membrane of *Sabella variegata* (Tortugas, Florida USNM 23567; a, columnar epithelium; b, cartilaginous sheath of skeleton; c, cartilaginous skeletal cells; d, basal groove; e, pinnule).

appendages is *Potamilla torelli* Malmgren, 1866 (Fig. 2B); and species with both pinnular appendages and radiolar appendages are *Demonax microphthalmus* (Verrill) (Fig. 7C) and *Megalomma heterops*, n. sp. (Fig. 43A). Ventral lips are paired structures on most Sabellinae but may be fused to some extent ventral to the mouth (Nicol 1931; also on *Laonome* Malmgren, 1866, see P. Knight-Jones, pers. comm.). On most Sabellinae, they begin on the dorsal end of paired lamellae which extend between ventral lappets of the collar and the beginning of the branchial lobes. Termed *parallel lamellae*, these lamellae may form vesiculate lobes which are termed *ventral sacs* on *Sabella* and some *Megalomma* species (e.g., *Megalomma bioculatum*, Fig. 38A, B; *M. pigmentum*, Fig. 41A–C), or they

may be short and straight, as on *Demonax* and other *Megalomma* species (*Demonax microphthalmus*, Fig. 7B). Free margins of ventral lips extend dorsally about to the dorsal lips, then turn ventrally and end on branchial lobes near the origins of ventralmost radioles; fused margins of ventral lips join proximal parts of radioles for about the lower half of branchial lobes (*Demonax pallidus*, Fig. 15F; *Sabella pavonina*.—Fauvel 1927:299, fig. 102a).

Branchial lobes usually originate on a short, fused, thick base. The radioles become separated from the skeleton of the branchial crown at this point. Broad flanges may occur on dorsal and ventral margins of bases of branchial lobes, as on *Notaulax* and *Pseudopotamilla*, or be absent, as on *Sabella*, *Demonax*, and *Megalomma*. When long, bases have been termed a *basal lamina* or *basal sheet* (*Notaulax nudicollis*, Fig. 27A, B). Radioles may be completely separated above the usually short base or longer basal lamina, or joined for part of their length by a palmate membrane. A *palmate membrane* (Figs. 2A, 27B) consists of an extension between the radioles of the outer part of the sheath of the radiolar skeleton covered on both sides by columnar epithelium (*Sabella variegata* Krøyer, 1856; Fig. 2C; *Sabella penicillus* of Orrhage, 1980:125, fig. 4).

The stem of a radiole consists of a skeleton comprised of vacuolate cartilaginous cells surrounded by an extracellular cartilaginous sheath containing some anastomosing cells. Each skeletal cell is surrounded by a thick-walled, chondroid matrix. The sheath of the skeleton is covered by columnar epithelium. The stem or rachis houses paired nerves, a coelomic space, blood sinus (Fig. 28Ba–c), and associated muscular and sensory structures, and on the interior surface produces alternating rows of ciliated pinnules on each side of a ciliated basal groove (Fig. 2C). The latter two structures function to collect and move food to the mouth. Radioles may have lateral rows of cilia (Fig. 6A–C) or be flanged on outer lateral corners. Flanges, usually found distally on radioles, are composed of a lateral extension of the sheath and possibly also skeletal cells and associated columnar epithelium (Fig. 28B–D). Satisfactory cross sections of radioles can usually be made on a microscope slide with a razor blade.

Demonax Kinberg, 1867

Demonax Kinberg, 1867:354; 1910:72.—Johansson, 1925:26, 27; 1927:136.—Berkeley and Berkeley, 1952:115.—Uschakov, 1955:412.—Hartman, 1959:541.—Fauchald, 1977a:138.

Parasabella Bush, 1905:191, 199, 200.

Distylidia Hartman, 1961:129 [in part].—Fauchald, 1977a:138.—Banse, 1979:870.

Sabella (*Demonax*).—Banse, 1979:877, 878.—Hobson and Banse, 1981:106, 107 [in part; not *Distylia voluticornis* var. *pacifica* Berkeley and Berkeley, 1954].

Type-species.—*Demonax krusensterni* Kinberg, 1867; subsequent designation by Bush (1905:191).

Kinberg (1867) originally included five species in *Demonax*. One species incorrectly reported by Kinberg as *Demonax tilosaulus* (not *Sabella tilosaula* Schmarda, 1861) is a *Chone* species according to Hartman (1959:514); the others, questionably including the type-species, are included in this paper under *D. leucaspis* Kinberg. Designation of *D. krusensterni* as the type-species by Bush (1905)

was unfortunate since figures of the other three included species were published posthumously in the second part of Kinberg's paper on the polychaetes of the Eugenie Expedition (Kinberg 1910), and the holotype of *D. krusensterni* is in poor condition (Johansson 1925; this paper). This was probably the reason *D. krusensterni* was omitted from Kinberg's (1910) paper. Johansson (1925) reexamined Kinberg's *Demonax* types and commented that *D. leucaspis*, *D. incertus*, *D. cooki*, and questionably *D. krusensterni* were all examples of a single species. Later (1927), he included them in all synonymy under *D. leucaspis*, with a questionable synonymy for *D. krusensterni*. Hartman (1959), following Johansson (1927), designated *D. leucaspis* as the type-species, a mistake in violation of Article 69 of the International Code of Zoological Nomenclature (1964), and others (Fauchald 1977a; Banse 1979) followed Hartman.

Diagnosis.—Radioles in semicircles or partial spirals arising from spiralling of cartilaginous bases of branchial lobes, in single row on cartilaginous bases or formed into 2 or 3 rows with inner semicircles or partial spirals apparently caused by bases of outer radioles "growing over" inner ones and forcing them toward middle of branchial crown, thus obscuring them from outside view; usually with longitudinal bands of cilia on outer lateral corners; without flanges or stylodes; with cartilaginous skeleton oval or reniform in cross section and formed of irregularly arranged cells; without palmate membrane; with or without simple eyespots. Dorsal lips with radiolar appendage functioning as midrib, with lamellae above and below joined to proximal part of midrib and 1–3 pinnular appendages (modified pinnules of first dorsal radiole) fused with upper lamella; ventral lips paired, well-developed, beginning ventrally between ventral lappets of collar, with margin extending dorsally to near dorsal lips, curving ventrally and joining bases of branchial lobes near first ventral radioles; ventral sacs absent. Collar bilobed, beginning dorsally on collar segment above setae, widely separated dorsally, entire laterally, ending ventrally in triangular or rounded lappets. Eight or fewer thoracic setigers. Collar setae of single type, in 2 short rows or elongate oval group, similar to upper setae of other thoracic setigers, often of unequal lengths; upper thoracic setae in arc above notopodial lobes, slender, with narrow hood; lower thoracic setae long and slender to short and nearly paleate, with hooded region broader in longitudinal plane of body than in transverse plane, in 2 or more transversely arranged rows or transversely arranged groups, often of unequal lengths. Thoracic tori with numerous avicular hooks and companion setae; avicular hooks with moderately long to long handles; companion setae slightly avicular, with tip enlarged into bulbous, well-defined, avicular head, with narrow, thin blade or mucro extending from narrow center of head or from penultimate tooth. Abdominal setae of single type, hooded, in 2 transverse rows or transverse elongate-oval group; abdominal avicular hooks similar to those of thorax but with shorter handles.

Remarks.—Previous concepts of the genus have emphasized the nearly paleate setae in lower parts of notopodia (Johansson 1927) or the nearly paleate setae and partially spiraled branchial lobes on *D. leucaspis* (Fauchald 1977a). These setae (Fig. 16A–D) can be considered to be short forms of broadly hooded setae. However, it is not entirely possible to designate points of separation in the continuum between nearly paleate setae, slightly more elongate hooded setae such as those that appear on *D. microphthalmus* (Fig. 7D–H), and longer, more slender,

slightly hooded setae such as those of *D. rugosus* (Fig. 10D–K). The same is true between partially spiraled and semicircular arrangements of radioles, which are definitely spiraled on type-specimens of all the included species described by Kinberg (1867). Radioles are slightly spiraled, probably from contraction, on a few large specimens of *D. microphthalmus* (Verrill) but not on others. They are partially spiraled on large but not small specimens of *D. rugosus* (Moore). Radioles are apparently added at the ventral margins of branchial lobes after the semicircle is completed. The same condition may be found on some *Sabella* species (Bush 1905:193). Other characters are common among all members of the genus except the development of more than one semicircle or partial spiral of radioles on large but not small specimens of *D. rugosus* (Moore) and *D. medius* (Bush). The development of additional rows of radioles, as in the case of the partially spiraled radiolar base on some species in the genus, is considered to be an ontogenetic character and not of generic importance. The most important character common to all members of the genus is the shape of companion setae; companion setae of species of most other genera of Sabellinae have thin, transparent, teardrop-shaped or pennonate blades at right angles to the shafts.

Sabella aulaconota Marenzeller (1884:210, pl. 2, fig. 8; = *Demonax aulacnotus*) from Japan was reported as an older synonym of *Parasabella media* Bush, 1905, by Johansson (1927; as *Sabella aulaconota*), who in the same paper reported *P. media* as a distinct species in *Demonax*. Monro (1933) referred *Sabella aulaconota* to *D. leucaspis* Kinberg. The species was reported as *Demonax aulaconota* by Hartman (1959) and by Imajima and Hartman (1964). I have not examined specimens of this species and can add nothing to the description. It may be similar to *D. medius* (Bush) but apparently has much longer lower thoracic setae. The description is insufficient for me to include it in the key.

A type-specimen of *Sabella japonica* Moore (Moore and Bush 1904:157–159, pl. 11, figs. 1, 2, pl. 12, figs. 39, 40) was examined and is also a *Demonax*; it is included in the key. *Demonax japonicus* and *D. lacunosus*, n. sp., are unique in the genus in having tori of the thorax well separated from ventral shields. Phyllis Knight-Jones (1983) discussed European and some other species of *Demonax*.

Distylia volutacornis var. *pacifica* Berkeley and Berkeley, 1954, referred to *Sabella* (*Demonax*) by Banse (1979), is not a species of *Demonax* and may not be a species of *Sabella* Linné, 1767. Thoracic setae are similar to those of *Sabella*, but the collar begins near the middorsal groove and forms distinct dorsolateral pouches. The type-specimen may be presently indeterminable to genus, since all tissue is lost from the branchial lobes, and only the cartilaginous skeleton remains.

In contrast to *Demonax* Kinberg, species of *Sabella* Linné, 1767, with type-species *Serpula penicillus* Linné, 1758, have palmate membranes between radioles occupying about 1/10 of their lengths; blade-like or spine-like lower thoracic setae organized into oval, longitudinal groups; companion setae with thin, teardrop-shaped or pennonate blades at right angles to shafts; and abdominal setae organized into spiral groups. Specimens reported as *Bispira volutacornis* from California by Berkeley and Berkeley (1961:662) (not *Amphitrite volutacornis* Montagu, 1804), and reported as ?*Sabella* sp. by Banse (1979:880) are a typical oculate *Sabella* species.

Potamilla Malmgren, 1866, with type-species *Sabella neglecta* Sars, 1850, has dorsal lips of the branchial crown without radiolar appendages, companion setae

similar to those of *Sabella* species, and may also have a short palmate membrane between radioles.

Pseudopotamilla Bush, 1905, with type-species *Amphitrite reniformis* Bruguière (1789:57; synonyms: “die nierenförmige *Amphitrite*” Müller, 1771:194; and *Amphitrite reniformis* Gmelin, 1791:3110, attributed to Linné 1788, in Hartmann 1959), has broad flanges on the upper and lower margins of the cartilaginous bases of the branchial lobes, companion setae like those of *Sabella* species but with thicker blades, and composite eyes occurring singly along some of the radioles. Except for being larger, species of *Eudistyla* Bush, 1905, differ from *Pseudopotamilla* Bush only in having branchial lobes with partially spiraled cartilaginous bases and in having numerous radioles organized into two or three rows. Radioles are organized in two or three rows on large specimens of *D. rugosus* (Moore) and *D. medius* (Bush), but are organized in single rows in other species of *Demonax*. It is likely that some small specimens from the northeast Pacific Ocean referred to *Pseudopotamilla* are conspecific with large specimens referred to *Eudistyla*. *Schizobranchia* Bush, 1905, differs from *Pseudopotamilla* in having dichotomously branched radioles.

Key to American Species of *Demonax*

- 1. Radioles in partial spiraled arrangement at least on large specimens ... 2
 - Radioles in semicircular arrangement on all sizes 3
- 2. Radioles forming 2 or more rows on large specimens; lower thoracic setae long, slender (Fig. 10D–K) *D. rugosus* (Moore)
 - Radioles in single row; lower thoracic setae short, broad (Fig. 5B–V) ...
..... *D. leucaspis* Kinberg
- 3. Companion setae with stout handles (Fig. 17G–I) . *D. jamaicensis* (Augener)
 - Companion setae with slender handles (Fig. 8A, B) 4
- 4. Radioles of large specimens in 2 rows, numbering up to about 40, with up to 27 in outer row; thoracic avicular hooks with long handles (Fig. 13O, P) *D. medius* (Bush)
 - Radioles in single rows of 20 or less; thoracic avicular hooks with handles of moderate length (Fig. 7J, K) 5
- 5. Ventral shield of collar segment broader than long; thoracic tori extending from notopodia to ventral shields 6
 - Ventral shield of collar segment about as long or longer than broad; thoracic tori well separated from ventral shields 8
- 6. Ventral shield of collar segment about twice broader than long
..... *D. microphthalmus* (Verrill)
 - Ventral shield of collar segment about 3 times broader than long 7
- 7. Lower thoracic notosetae with hooded parts (including tips) 3–4 times longer than broad (Fig. 16A–D); radioles with “diffuse eyespots” or uncolored, without cross-bands of reddish-brown *D. pallidus* (Moore)
 - Lower thoracic notosetae with hooded parts (including tips) 4–5 times longer than broad (Fig. 20B, C); radioles without “diffuse eyespots,” with about 7 dark, reddish-brown cross-bands *Demonax* sp.
- 8. Ventral shield of collar segment longer than broad, with grooves forming “V” with apex anterior; 15 pairs of radioles *D. japonicus* (Moore)

- Ventral shield of collar segment about as long as broad, plain; up to 10 pairs of radioles *D. lacunosus*, n. sp.

Demonax leucaspis Kinberg, 1867

Figs. 3–5

?*Demonax krusensterni* Kinberg, 1867:354.—Bush, 1905:191.—Johansson, 1925: 22, 24, fig. 8, no. 1–6.

Demonax leucaspis Kinberg, 1867:354; 1910:72, pl. 27, fig. 8.—Johansson, 1925: 24, fig. 8, no. 7–11; 1927:136, text-fig. 14, no. 4, 6, 7.—?Monro, 1933:1075, 1076, text-fig. 22 [in part, not *Parasabella media* Bush, *P. maculata* Bush, *P. pallida* Moore and *Sabella aulaconota* Marenzeller].—Hartman, 1966:235, 236 [diagnosis partly incorrect; no additional specimens].

Demonax incertus Kinberg, 1867:354; 1910:73, pl. 28, fig. 1.—Johansson, 1925: 22, 24, fig. 8, no. 1–6.

Demonax cooki Kinberg, 1867:355; 1910:73, pl. 28, fig. 2.—Bush, 1905:186.—Johansson, 1925:26, fig. 9, no. 5–8.—Hartman, 1959:541.

Material examined.—PERU: Holotype of *D. leucaspis*, San Lorenzo Is., near Callao, intertidal [*summa aqua* = highest water], Eugenie Expedition, 1851–1853 (NRS 575).—CHILE: Holotype of *D. incertus*, Valparaiso, under seaweed on sand and stone, 4–6 m, Eugenie Expedition, 1851–1853 (NRS 580).—HAWAII: Holotype of *D. krusensterni*, Honolulu, Oahu, under dead coral on beach [*summa aqua*], Eugenie Expedition, 1851–1853 [damaged specimen; NRS 577]. Two syntypes of *D. cooki*, Honolulu, Oahu, under dead coral on beach [*summa aqua*], Eugenie Expedition (NRS 579).

Description.—Tube unknown. Lateral sides and pinnules of branchial lobes cross-banded on type of *D. incertus* (Johansson 1925), highly colored on syntypes of *D. cooki* (color partially retained); all other types now with branchial crown uncolored (but epithelium lost and only skeleton remaining on type of *D. krusensterni*). Total length 9–27 mm, width 2–4 mm, 50–65 setigers. Branchial crown $\frac{1}{3}$ – $\frac{1}{5}$ body length, 21 plus single vestigial pairs of radioles on types of *D. leucaspis* and *D. incertus*, 10–17 on syntypes of *D. cooki*, 27 on type of *D. krusensterni*; all spiraled about $1\frac{1}{2}$ semicircles (Fig. 3A); radioles with smooth tips about 0.4 mm long and gradually lengthening pinnules (Fig. 4A) on type of *D. leucaspis*, similar on some radioles of type of *D. incertus* and syntypes of *D. cooki*; radiolar skeletons in cross section (Fig. 4C, E, G–I) with numerous cells, with thick sheath surrounded by moderately thick columnar epithelium; basal pinnular skeletal cells flattened, wider than long (except on syntype of *D. cooki* which has some long ones), others gradually decreasing in width and increasing in length distally (Fig. 4B, D, F). Dorsal lips short, triangular, with radiolar appendage joined by lamella to single upper filament (pinnular appendage), fused with branchial lobes at base of first dorsal radiole. Collar extending for about half length of fused base of branchial crown but perhaps shorter on type of *D. leucaspis* (Kinberg, 1910: pl. 27, fig. 8, pl. 28, figs. 1, 2), beginning about half distance from collar setae to dorsal groove, concave ventrolaterally, ending in short, rounded lappets at ventral incision, damaged on type of *D. krusensterni*. Thorax with 8 setigers, with slight depression on anterior dorsal part; notopodial lobes short, conical. Ventral shields of setiger 1 (collar segment) short, $3\frac{1}{2}$ –5 times broader than long (Fig. 3B–E), only slightly

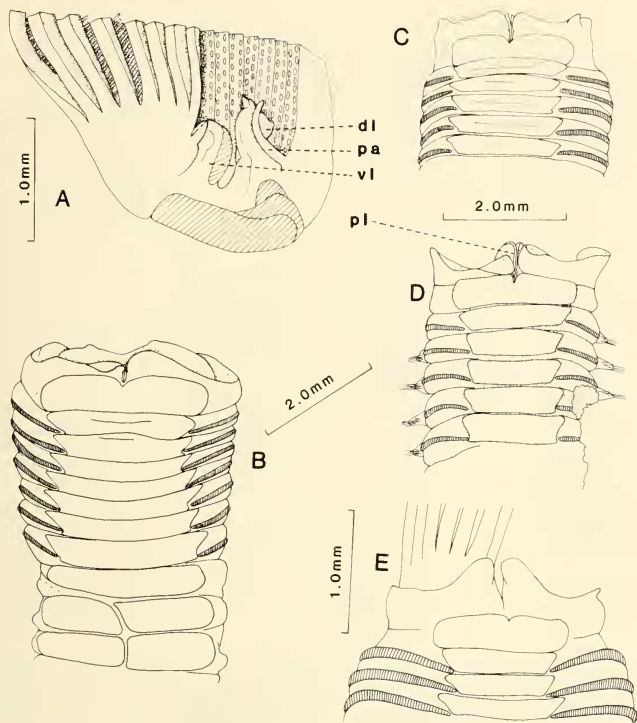


Fig. 3. *Demonax leucaspis*: A, Proximal part of detached branchial crown of holotype of *D. leucaspis* right half, medial view; B, Anterior end of body of holotype of *D. krusensterni*, ventral view; C, Same, of *D. leucaspis*; D, Same, *D. incertus*; E, Anterior end of body and lower part of half of branchial crown, syntype of *D. cooki*.

longer than those following, rectangular, with rounded corners but incised anteromedially; ventral shields of other thoracic setigers trapezoidal, broader anteriorly; not as broad on types of *D. cooki* as on others. Collar segment with 2 short rows of slender, narrowly hooded setae; other thoracic segments with curved, upper, longitudinal row of slender, narrowly hooded setae (Fig. 5A) above 2 or more transverse rows of short, broadly hooded setae; lower thoracic setae of anterior row shorter, broader than on posterior row, with hooded part about 3 times broader than shaft and, including tips, 5 times as long as broad; posterior row of setae slightly longer and more slender, with hooded part about twice broader than shaft and, including tips, 6 times longer than broad on type *D. leucaspis*;

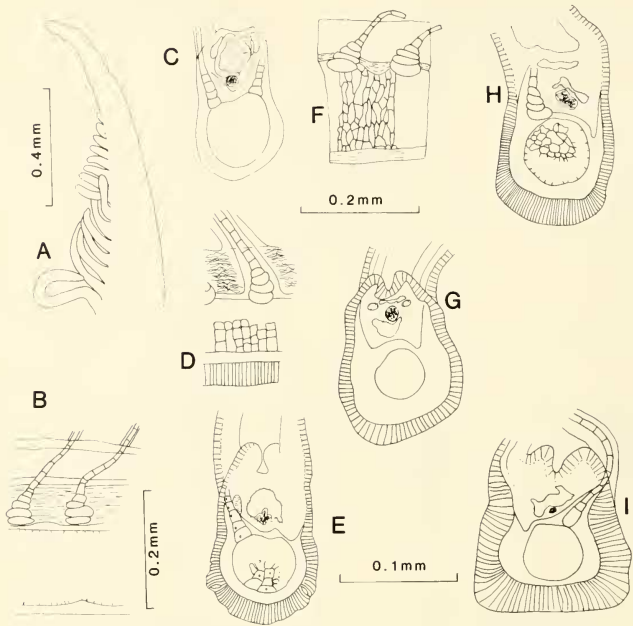


Fig. 4. *Demonax leucaspis*: A, Tip of fourth dorsal radiole, holotype of *D. leucaspis*; B, Internal structure of radiole, holotype of *D. krusensterni*, sagittal view, skeletal cells and columnar epithelium missing; C, Cross section of radiole of same; D, Internal structure of radiole, *D. incertus*, sagittal view; E, Cross section of same; F, Internal structure of radiole, *D. leucaspis*, sagittal view, columnar epithelium omitted; G, Cross section of same, skeletal cells lost; H, Same, skeletal cells damaged; I, Cross section of radiole, *D. cooki*, skeletal cells lost.

broader, shorter and all similar on type of *D. incertus* and syntypes of *D. cooki*; all similar and intermediate between anterior and posterior ones of *D. leucaspis* on type of *D. krusensterni* (Fig. 5B–V). Thoracic avicular hooks with moderately long handles (Fig. 5W) and companion setae (Fig. 5X), in long tori from notopodia to ventral shields; companion setae with slender shaft, with broadly winged, avicular head, with long, slender, hyaline mucro extending from middle of outer part of tip and beak. Abdominal avicular hooks similar to those of thorax but with shorter handles; abdominal setae hooded, in 2 transverse rows.

Remarks.—Kinberg's figure of *D. cooki* (Kinberg, 1910: pl. 28, fig. 2) is incorrect in showing the collar extending past the fused base of the branchial crown; in fact, collars of syntypes of *D. cooki* are similar to those of other specimens (Fig. 3E). Also, the long basal pinnular skeletal cells found in radioles of *D. cooki* (Fig. 4I) are, in my opinion, a juvenile character.

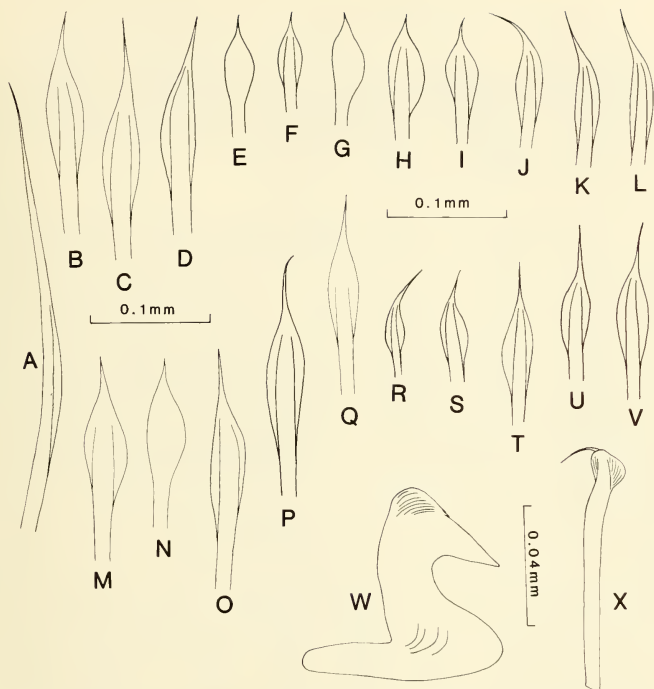


Fig. 5. *Demonax leucaspis*: A, Upper thoracic seta, *D. krusensterni*; B-D, Lower thoracic setae, *D. krusensterni* (B, upper; C, middle; D, lower); E-L, Lower thoracic setae, *D. incertus* (E, Upper, anterior row; F, Same; G, middle, anterior row; H, Lower, anterior row; I, Upper, posterior row; J, Same; K, Middle, posterior row; L, Posterior row); M-Q, Lower thoracic setae, *D. leucaspis* (M, Upper, anterior row; N, Same; O, Upper, posterior row; P, Same; Q, Lower); R-V, Lower thoracic setae, *D. cooki* (R, Upper, anterior row; S, Same; T, Lower anterior row; U, Upper, posterior row; V, Lower, posterior row); W, Thoracic avicular hook, *D. cooki*; X, Companion seta of same.

Although this species is widespread (tropical Hawaii, warm temperate western South America and questionably tropical western Central America) there are only minor differences among the types examined. There are slight variations of shape of lower thoracic notosetae between anterior and posterior rows, number of radioles, length of branchial crown compared with body length, width of thoracic ventral shields compared with body width, and coloration of branchial crown. However, without more and better preserved specimens from the three type-localities, I cannot determine that any of these differences are important, and thus concur with Johansson (1925, 1927) that the types represent but a single species.

Demonax microphthalmus (Verrill, 1873), new combination

Figs. 6–8

Sabella microphthalma Verrill, 1873:618.—Johansson, 1927:128.—Hartman, 1942a:80; 1945:47; 1951:117.—Taylor, 1961:253; 1971:720–722.—Wells and Gray, 1964:74.—Smith 1964:57, 76 [key], pl. 9, figs. 53, 54.—Kerby, 1972:16–22, figs. 1–7 [complete synonymy; not specimen from Puerto Rico].—Day, 1973:127.—Hall and Saloman, 1975:19.

Parasabella microphthalma.—Bush, 1905:200.

Material examined.—MASSACHUSETTS: Vineyard Sound and vicinity, USFC, 1871, 9 syntypes (USNM 13079).—NORTH CAROLINA: Cape Hatteras, N. Jetty, coll., H. W. Wells, 6 Aug 1960, 5 specimens (USNM 65902). Cape Lookout, intertidal; woven into tube of cerianthid, coll. Fox, 6 Apr 1974, 7 specimens (USNM 53986). Same, in cemented material of *Petaloproctus socialis* Andrews, coll. H. Wilson, Nov–Dec 1974, 6 specimens (USNM 53985). Bogue Sound, E. of Atlantic Beach bridge, sand, shells, 2.5 m, coll., M. E. Petersen and class, 10 May 1972, 3 specimens (ZMC).—FLORIDA: Off Cape Canaveral, 28°35.9'N, 80°18.6'W, 26 m, on *Argopecten gibbus*, R/V *Hernan Cortez*, coll., D. Barber *et al.*, 6 Mar 1974, 5 specimens (FSBC I 23784). Indian River Coastal Zone Study, sta 130D, Haulover Canal, Brevard County, E. side of river on N. shore of NE spoil bank, 10 m offshore, 2 Dec 1975, 18 specimens (IRCZM 50:585). Same, sta 63A, Banana River, Eau Gallie, Brevard County, E. of marker no. 1, N. of harbor cut, 10 m offshore, 30 Jul 1974, 1 specimen (IRCZM 50:587). Same, sta 73C, Brevard County, just N. of Sebastian Inlet on NE side of river, 100 m offshore, 10 Oct 1974, 3 specimens (IRCZM 50:586). Same, sta 81C, 15 Nov 1974, 1 specimen (IRCZM). Same, sta 81D, 15 Nov 1974, 2 specimens (IRCZM). Same, sta 105A, 27 Mar 1975, 2 specimens (FSBC I 23786). Same, sta 173B, Fort Pierce, St. Lucie County, W. side of river, 100 m N. of N. jetty of Link Port Canal, 13 m offshore, 20 Apr 1976, 2 specimens (IRCZM 50:584). Same, sta 136B, 8 Dec 1975, 2 specimens (FSBC I 23787). Canaveral Pool, Indian River, Brevard County, coll., R. Ernest *et al.*, Dec 1978, 10 specimens (FSBC I 23785). Hutchinson Island, sta II, 27°21.6'N, 80°13.2'W, 11 m, coarse calcareous sand, 2 specimens (FSBC I 23788, 23789). Same, sta IV, 27°20.7'N, 80°12.8'W, 11 m, coarse calcareous sand, 2 specimens (USNM 54723; FSBC I 23790). Same, sta V, 27°22.9'N, 80°13.9'W, 11 m, coarse calcareous sand, 2 specimens (USNM 54724; FSBC I 23791). About 27 km ENE of Ft. Pierce Inlet, 27°33.2'N, 80°03.2'W, 33 m, sand and shell, R/V *Johnson*, coll., R. W. Virnstein, 1977, 20 juvenile specimens (IRCZM 50:850). Same, R/V *Gosnold*, coll., R. W. Virnstein, 1977, 2 juvenile specimens (IRCZM 50:851). Off St. Lucie Inlet, 27°11.2'N, 80°01'W, 41.8 m, on coral *Oculina varicosa* Lesueur, JSL II 144, coll., F. Stanton, 26 Oct 1976, 1 specimen (IRCZM 50:853). National Marine Fisheries Service, Tampa Bay area study, coll., J. Taylor and C. Saloman, 1963–1964, Terra Ceia Bay, 27°32'04"N, 82°35'47"W, 1 m, algae, *Halodule* and *Syringodium* cover, 1 specimen (FSBC I 13444). Same, Old Tampa Bay, 27°53'43"N, 82°36'34"W, 2 m, sand, algae and *Syringodium* cover, 1 specimen (FSBC I 10430). Same, 27°54'53"N, 82°38'44"W, 1 m, sand, algae and *Halodule* cover, 1 specimen (FSBC I 13223). Same, Boca Ciega Bay, 27°43'27"N, 82°43'24"W, 2 m, sand, 1 specimen (FSBC I 12535). Same, 27°40'37"N, 82°41'13"W, 1 m, sand, algae, *Syringodium* and *Thalassia* cover, 1 specimen (FSBC I 12603). Same, 27°41'09"N, 82°42'51"W, 1 m, sand,

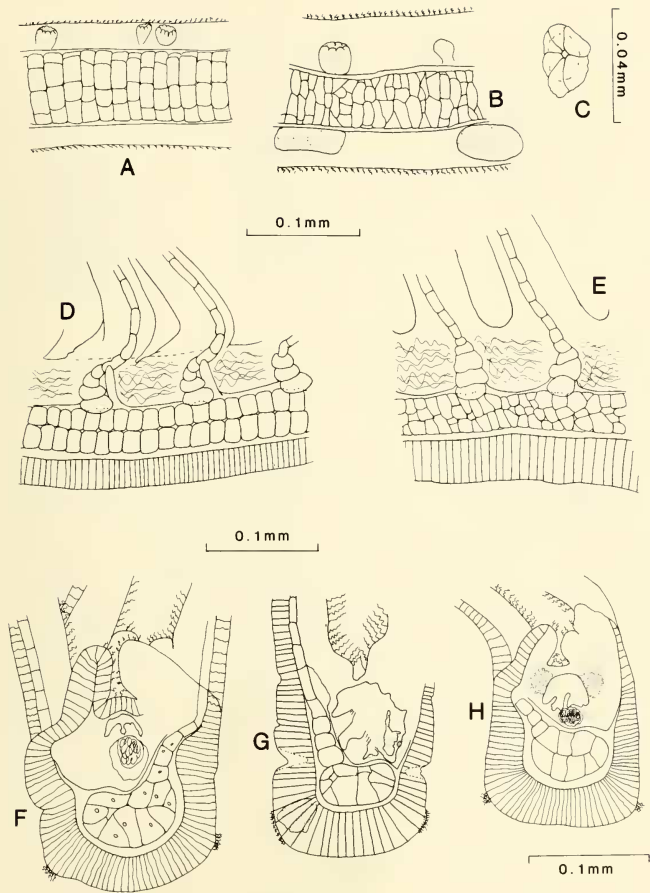


Fig. 6. *Demonax microphthalmus*: A, B, Internal structure of radioles, frontal view; C, Structure of radiolar eyespot, surface view, magnified; D, E, Internal structure of radioles, sagittal (lateral) view; F–H, Cross sections of radioles (A, C, D, FSBC I 17307, FSBC I 23784; B, E, G, USNM 53985; F, syntype; H, FSBC I 23790).

algae and *Thalassia* cover, 4 specimens (FSBC I 12744). Same, 27°38'58"N, 82°41'58"W, 2 m, sand, algae and *Syringodium* cover, 2 specimens (FSBC I 12793). Same, 27°45'18"N, 82°44'53"W, 1 m, sand, algae and *Thalassia* cover, 9 specimens (FSBC I 13293). Same, 27°45'20"N, 82°44'48"W, 1 m, sand, 20

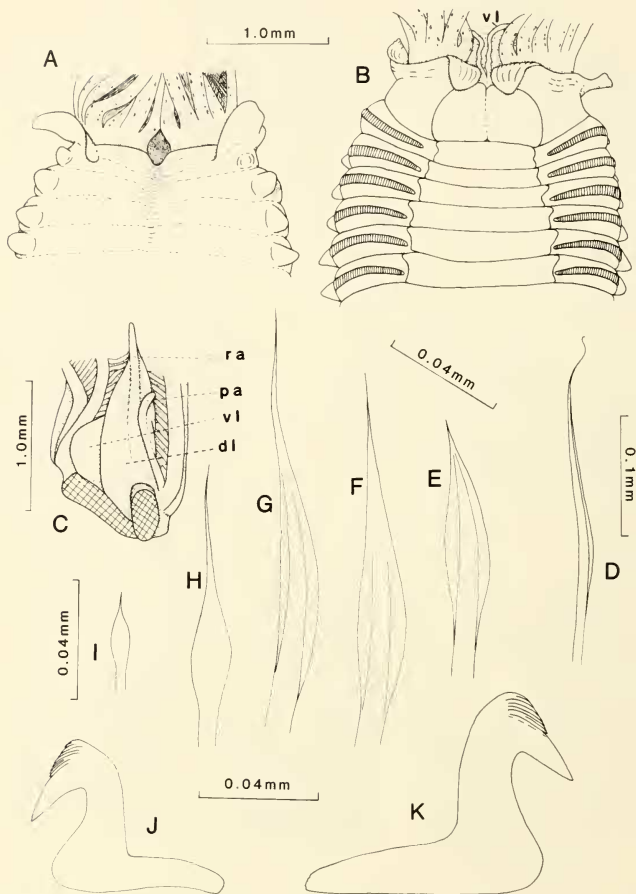


Fig. 7. *Demonax microphthalmus*: A, Anterior end of body and part of branchial crown, dorsal view; B, Same, ventral view; C, Lower part of right half of branchial crown, medial view, showing dorsal lips and ventral lips; D, Upper thoracic seta; E-I, Lower thoracic setae (E, Upper, anterior row; F, Lower, anterior row; G, Upper, posterior row; H, Middle of bundle of juvenile; I, Upper part of bundle of same); J, K, Thoracic avicular hooks (A-G, Syntypes; H, I, FSBC I 14534; J, FSBC I 23789; K, USNM 53985).

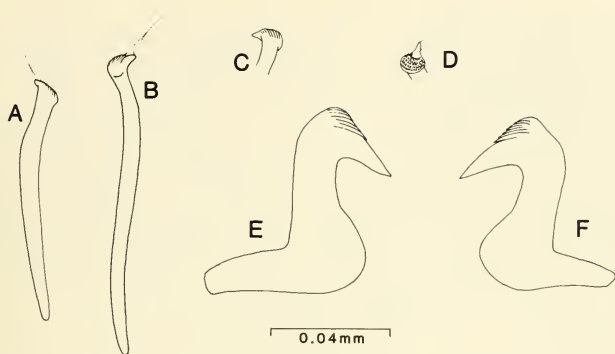


Fig. 8. *Demonax microphthalmus*: A–D, Companion setae; E, F, Abdominal avicular hooks (A, F, FSBC I 23789; B, E, USNM 53985; C, D, FSBC I 23790).

specimens (FSBC I 13298). Same, 27°46'35"N, 82°45'53"W, 3 m, silty sand, 6 specimens (FSBC I 13304). Same, 27°37'33"N, 82°43'43"W, 2 m, sand, algae and seagrass cover, 19 specimens (FSBC I 13525). Same, 27°48'17"N, 82°45'53"W, 2 m, sand, 17 specimens (FSBC I 14532). Same, 27°48'17"N, 82°45'53"W, 2 m, sand, algae cover, 17 specimens (FSBC I 14534). Same, 27°44'35"N, 82°44'37"W, 1 m, sandy mud, algae and *Thalassia* cover, 12 specimens (FSBC I 14551). Same, 27°44'35"N, 82°44'37"W, 1 m, sand, algae and *Thalassia* cover, 4 specimens (FSBC I 14558). Same, 27°43'52"N, 82°42'23"W, 2 m, sand, 3 specimens (FSBC I 14569). Anclote Anchorage, Tarpon Springs, Pinellas County, 28°12.7'N, 82°46.7'W, 1.5 m, sand, seagrass cover, coll., J. Studt and R. Ernest, 26 Jul 1972, 2 specimens (FSBC I 17307). Seahorse Key, Cedar Keys, Levy County, on shells and pilings, coll., J. Taylor, 1960, 4 specimens (FSBC I 23783). Northeastern Gulf of Mexico, Proj. EGMEX 70, sta 22, 28°04'N, 84°41'W, 76.8 m, dredged, R/V *Hernan Cortez*, coll., J. Williams *et al.*, 9 May 1970, 3 specimens (FSBC I 23781). Same, Proj. EGMEX 70, sta 4, 29°07'N, 85°20'W, 36.5 m, 5 May 1970, 23 specimens (FSBC I 23782). Florida Middle Ground, 28°32'20"N, 84°18'36"W, 23–27 m, on coral, *Madracis detactis* (Lyman), BLM Cruise no. 1, sta 151, 5 Oct 1978, 2 specimens (USNM 61102). —PUERTO RICO: San Juan Harbor, 0–4 m, coll., J. Bruce, 27 May 1975, 1 specimen (USNM 53235). —COLOMBIA: Bahia de la Cartagena, 10°30'N, 75°30'W, less than ½ m, coll., R. Rojas, 1 specimen (USNM 49660).

Description.—Tube mostly rigid, usually orange, covered with cemented sand grains; white, not rigid, sparsely covered with sand grains on Hutchinson Island specimens. Some branchial lobes with 5–6 orange-brown to reddish-brown pigment bands, with pigment also extending onto pinnules; often without pigment bands; radioles with simple eyespots in 2 irregular rows laterally on outer sides; eyespots variable in size, dark orange, red to reddish brown, occasionally absent,

diffuse or distinct and in some specimens, composed of distinct cells surrounding clear central areas, often combined to form dashes of varying lengths (Fig. 6A–C). Body without color pattern; pygidium with eyespots; pair of eyespots on prostomium of some small, apparently juvenile, specimens (IRCZM 50:850, 50:851); maximum body length about 50 mm, width to about 4 mm; branchial crown up to 12 mm long or about $\frac{1}{4}$ as long as body; maximum of about 80 segments; largest syntype about 18 mm total length, 2.5 mm width, with about 50 segments. Branchial crown with maximum of 17 pairs of radioles, mostly with 10–14, arranged in semicircles, rarely with 2–3 pairs of radioles on ventral sides extending in very slight spiral (FSBC I 13298, 14584). Radiolar basis fused for short length, extending about as far as anterior margin of collar. Radioles with 30–100 pinnules, tips flattened, tapered; basal cell of pinnular skeleton in lateral view mostly not recessed into radiolar skeleton, next 2–3 cells flattened, nearly rectangular (Fig. 6D, E); radioles in cross section (Fig. 6F–H) with rounded outer corners, with ciliated band on or medial to corners; radiolar skeleton with thin sheath; sheath surrounding reniform group of about 8–12 skeletal cells and surrounded by thick columnar epithelium; dorsal lips (Fig. 7C) about $\frac{1}{4}$ length of radioles; ventral lips about half as long. Collar (Fig. 7A, B) beginning above collar setae, extending to beginning of radioles dorsolaterally, slightly concave laterally, ending ventrally in slightly elongate, often overlapping, rounded-triangular lappets. Thorax of 8, rarely 7 or 9, setigers, usually somewhat fusiform; notopodial lobes conical; tori long, extending from notopodia to ventral shields; ventral shield of collar segment (Fig. 7B) moderately long, about twice as broad as long, usually superficially divided by longitudinal line, incised anteriorly; ventral shields of other thoracic segments gradually broader, trapezoidal, with broader anterior margins, lateral margins concavely curved around ventral margins of tori. Upper thoracic setae slender, narrowly hooded (Fig. 7D); lower thoracic setae (Fig. 7E–G) in 2 transverse rows, with moderately long, broad hooded region and drawn-out tips; hooded region about twice as broad as shafts and, including tips, 5–10 times longer than broad on adults, differing slightly on juvenile specimens (Fig. 7H, I). Thoracic avicular hooks (Fig. 7J, K) in rows of up to 50 on setiger 2, diminishing posteriorly, larger in upper parts of tori, smaller posteriorly, crest above beak with about 100 fine teeth; companion setae (Fig. 8A–D) with avicular heads, with crests of numerous small teeth, with hyaline mucro extending from entire center line and ending in fine tip. Abdominal avicular hooks (Fig. 8E, F) in short rows of up to about 30.

Remarks.—The presence of *D. microphthalmus* is confirmed from shallow water areas of the east coast of the Americas from Massachusetts to Florida, the Gulf of Mexico, Puerto Rico, and Colombia. Rullier and Amoureux (1979) reported a damaged specimen from Brazil as *D. microphthalmus*. However, little descriptive information was given, and I cannot confirm their record.

Demonax rugosus (Moore, 1904), new combination

Figs. 9, 10

Distylia rugosa Moore, 1904:499–501, pl. 38, figs. 38–41; 1909:289.—Loi, 1980: 143, 144.

Demonax medius.—Berkeley and Berkeley, 1952:115 [not *Parasabella media* Bush, 1905].

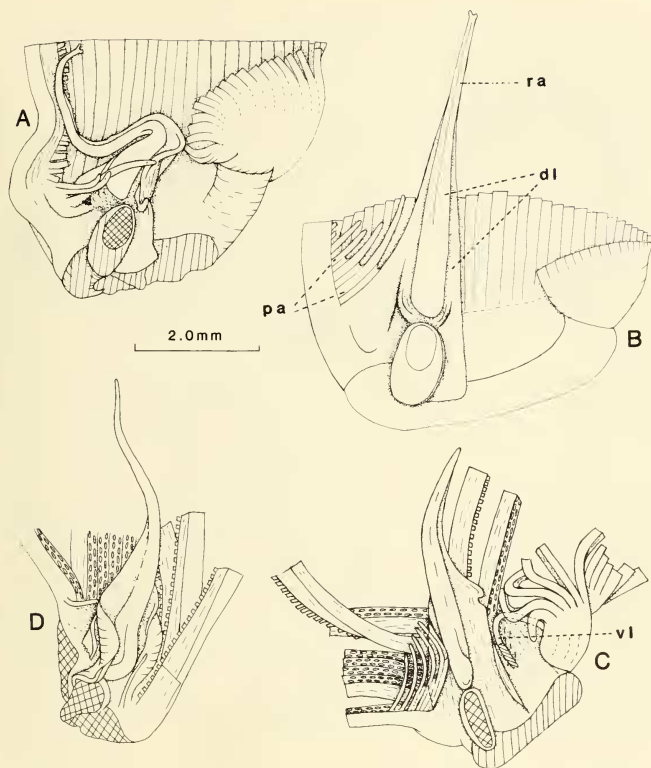


Fig. 9. *Demonax rugosus*: A. Proximal part of left half of branchial crown, medial view; B, Same, diagrammatic; C, Same; D, Same, right half of branchial crown of juvenile (A, B, Paratype, ANSP 2596; C, USNM 41465; D, USNM 41464).

Distylidia rugosa.—Hartman, 1961:129; 1969:667 [in part; figures = *Demonax medius* (Bush)].—Banse, 1979:870.

Sabella (Demonax) media.—Banse, 1979:878–880.—Hobson and Banse, 1981: 107. [in part; not *Parasabella media* Bush].

Material examined.—CALIFORNIA: Paratype, San Diego, coll., E. C. Starks, (listed as cotype; ANSP 2596).—WASHINGTON: Off Lake Hancock, Whidby Is., 36–72 m, coll., M. Pettibone, 1 Jul 1938, 1 specimen (USNM 44855). San Juan Channel, 140 m, coll., M. Pettibone, 10 Jul 1940, 1 specimen (USNM 44853).

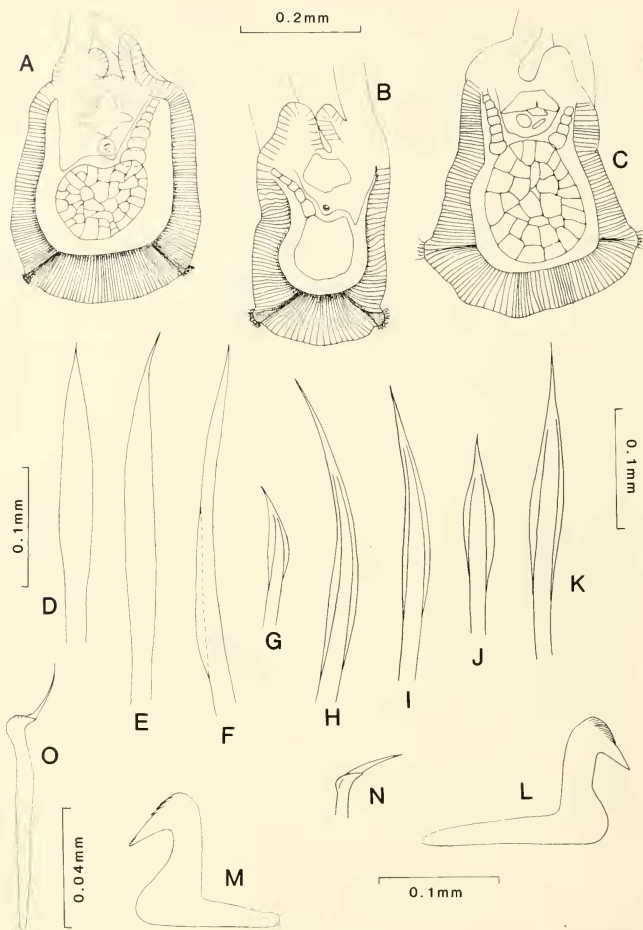


Fig. 10. *Demonax rugosus*: A-C, Cross sections of radioles; D-K, Lower thoracic setae (D, Middle, anterior row; E, Upper, posterior row; F, Same, turned; G, Upper, anterior row; H, I, Posterior row; J, Anterior row; K, Posterior row); L, Thoracic avicular hook, large specimen; M, Same, small specimen; N, Companion seta; O, Same, small specimen (A, D-F, Paratype, ANSP 2596; B, G-I, L, N, USNM 41465; C, J, K, USNM 41464; M, O, USNM 38241).

Same, among *Modiolus*, 12 Jul 1940, 1 specimen (USNM 44856). Friday Harbor, San Juan Is., on cannery pilings, coll., M. Pettibone, 23 Aug 1938, 1 specimen (USNM 44857). Puget Sound, 47°44'31"N, 122°31'53"W, Haul 10, 22 m, Apr 1963, 3 juveniles (station 3 of Banse and Hobson, 1968; USNM 38241).—BRITISH COLUMBIA: (?) Gabriola Pass, 11 Jun 1920, 3 specimens (USNM 41464). Ucluclet, coll., J. Hart, May 1935, 1 specimen (USNM 41465). Reef in Pearse Canal, 54°50.3' N, 130°28.4'W, less than 23 m, shell, cobble, coll., P. Lambert, 13 Jun 1974, 1 specimen (BCPM 974-224-68).

Description.—Large species with body up to 70 mm long, 8 mm wide, branchial crown to about 20 mm long, body usually depressed, 8 thoracic and about 100 abdominal setigers. Tube similar to that of *D. medius* (Bush); radioles stiff, up to about 60 on each side, in spiraled arrangement of about $1\frac{1}{4}$ semicircles (Fig. 9A–C), in 2–3 irregular rows on each side on larger specimens (including paratype), single row on smaller specimens (USNM 41465). Radiolar skeletons in cross section (Fig. 10A–C) composed of numerous irregular cells surrounded by thick sheath. Dorsal lips (Fig. 9A–D) tapered, with radiolar appendage functioning as midrib, upper lamellae fused at upper margin with up to 3 enlarged pinnules of first dorsal radiole; dorsolateral parts of dorsal lips joined with short length of upper part of base of each branchial lobe and initially angled to ventrum. Collar beginning about $\frac{1}{2}$ distance between collar setae and midline, ending at ventral incision in short, rounded lappets, extending for about $\frac{1}{2}$ length of fused region at base of branchial crown [collar about as long as that of *D. medius* (Bush) but fused base of branchial crown longer]. Ventral shield of collar segment about 3 times wider than long, anteromedially incised, wider than other thoracic ventral shields and about twice as long; other thoracic ventral shields trapezoidal with anterior margins broader than posterior ones; shields gradually increasing in width posteriorly. Posterior dorsum rugose. Lower thoracic notosetae (Fig. 10D–K) very long, longer on posterior parts of bundles than on anterior, hooded region, including tips, 10–12 times longer than wide, $1\frac{1}{2}$ times as wide as shafts. Thoracic tori long, extending from setae to ventral shields, with up to about 100 avicular hooks on setiger 2 accompanied by equal number of companion setae. Avicular hooks (Fig. 10L, M) of upper parts of thoracic tori of adults with free part of handles slender, long; companion setae (Fig. 10N, O) similar to those of *D. medius* (Bush).

Remarks.—Hartman (1961:129) designated *Distylia rugosa* Moore as the type-species of her new genus, *Distylidia*. The species differs from the type-species of *Parasabella*, *P. media* Bush, in having partly spiraled branchial lobes on adults and much longer lower notopodial setae in the thorax. The species differs from the included species of *Demonax* Kinberg, *D. krusensterni*, *D. leucapsis*, *D. cooki* and *D. incertus*, in having branchial lobes of adults with 2–3 rows of radioles on each side rather than single rows and also much longer, lower setae in the thorax. I do not consider the above characters to be of generic importance. Thus, *Distylia rugosa* Moore, the type-species of *Distylidia* Hartman, is included in *Demonax* Kinberg.

The posterior dorsa of large specimens of *Demonax medius*, *D. pallidus* (Moore), and *D. rugosus* are rugose, a feature not clearly characterizing the latter species. Hartman (1961) was apparently mistaken in stating that the rugose folds on the dorsum of *D. rugosus* “most clearly characterized” the genus *Distylidia*.

Demonax medius (Bush, 1905)

Figs. 11–14

Parasabella media Bush, 1905:200, 201, pl. 27, figs. 3–5, pl. 33, figs. 34–36, pl. 34, fig. 3, pl. 36, figs. 13, 14, pl. 37, fig. 30.

Parasabella maculata Bush, 1905:201, pl. 28, figs. 8, 9, pl. 33, figs. 8, 12, 33, pl. 34, fig. 2, pl. 36, figs. 12, 15, 16, 21, 22.

Potamilla californica.—Moore, 1923:243 [not Treadwell, 1906].

Sabella aulaconota.—Johansson, 1927:124, 215 [in part].

Demonax medius.—Johansson, 1927:136.—Hartman, 1969:675, 676, figs. 1–5 [in part; not *Parasabella pallida* Moore and probably not other specimens from southern California].

Sabella media.—Hartman, 1942a:79, 80, figs. 159, 160; 1944:285, pl. 23, fig. 42 [in part; not *Parasabella pallida* Moore].

Distylia rugosa.—Berkeley and Berkeley, 1952:112, figs. 230–232 [not Moore, 1904].

Distylidia rugosa.—Hartman, 1969:667 [in part; figs. 1–5 only, taken from Berkeley and Berkeley, 1952; not *Distylia rugosa* Moore].

Sabella (*Demonax*) *media*.—Banse, 1979:878, fig. 4c, d.—Hobson and Banse, 1981:107 [in part].

Material examined.—ALASKA: Holotype of *P. media* Bush [figured specimen designated as holotype in vial], Kodiak Is., coll., W. R. Ritter, 3 Jul 1899 (YPM 2691); 8 paratypes, same data (YPM 2692, 2693). Holotype of *P. maculata* Bush, Kodiak Is., coll., W. R. Coe, 3 Jul 1899 (YPM 2775). Canoe Bay, off NW corner of Pavlof Bay, Alaska King Crab Investigation, coll., W. L. Schmitt, 23 Sep 1940, 1 specimen (USNM 23536).—BRITISH COLUMBIA: Mudge Is., 28 May 1919, 24 specimens (USNM 40332). Off Pilot Bay, Lomb Bay, Aug 1931, off rock, 2 specimens (USNM 41502). Vancouver Is., west coast, 3 specimens (USNM 41503). Sooke Reef, Vancouver Is., coll., Fernald, 10 Jul 1976, 4+ specimens (BCPM 977-231-1). Mudge Is., 30 Aug 1913, 1 specimen (USNM 41505). Mouth of Winter Inlet, 54°50.3'N, 130°28.2'W, 6–9 m, shell and mud, coll., P. Lambert, 11 Jun 1974, 1 specimen (BCPM 974-222-29).—WASHINGTON: False Bay, San Juan Is., in roots of sea basket grass, coll., M. Pettibone, 14 Aug 1936, 1 juvenile specimen (USNM 44854).—CALIFORNIA: Bodega Bay, coll., L. C. Oglesby, 6 May 1961, 2 specimens (USNM 39619, 39674). Monterey Bay, *Albatross* sta 4496, 18 m, 19 May 1904 [as *Potamilla californica* by Moore], 1 specimen (USNM 17119).

Description.—Tube leathery, thick but moderately flexible, translucent, yellow to reddish brown, often partially covered with fine sediment or detritus. Large species up to 10 cm long. Radioles in semicircular to slightly spiraled arrangement, additional irregular medial row on adults (Fig. 11A–E); up to 27 outer radioles and 10 inner ones on each side. Radiolar skeletons in cross section (Fig. 12A–F) with numerous (20–60) irregularly arranged cells surrounded by thin sheath and moderately thick columnar epithelium, ciliated on rounded outer lateral margins on most specimens [however, cilia not present on type-specimens of *Parasabella media* and on another specimen from Alaska (USNM 23536)]; proximal skeletal cells reduced in number, with thicker walls, slightly increased in number distally,

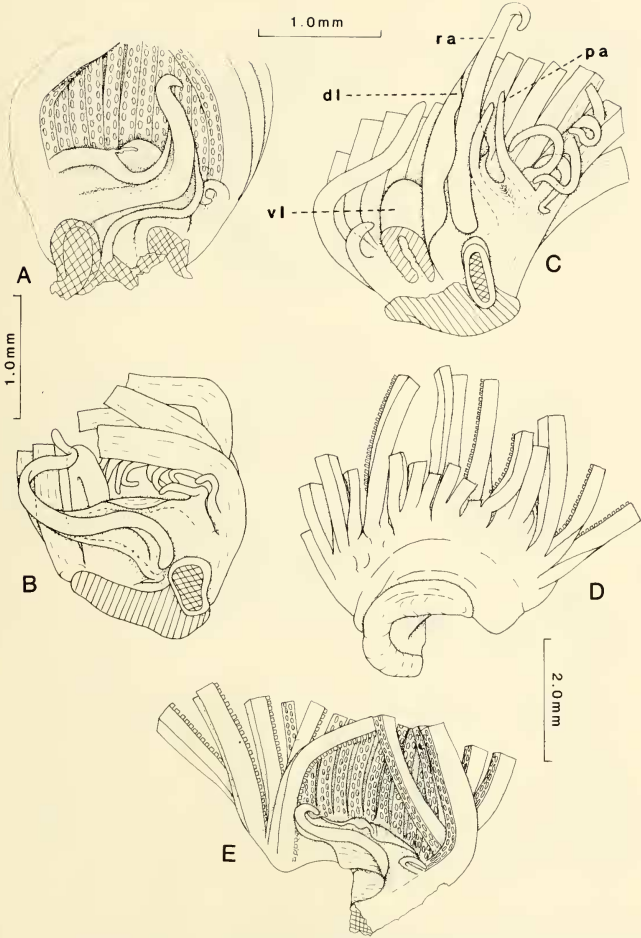


Fig. 11. *Demonax medius*, Proximal parts of branchial crown: A, Left half, medial view, holotype of *Parasabella media*; B, Right half, medial view, paratype of *Parasabella media*; C, Same, holotype of *Parasabella maculata*; D, Right half, outer view; E, Same, medial view (B, YPM 2693; D, E, USNM 41502).

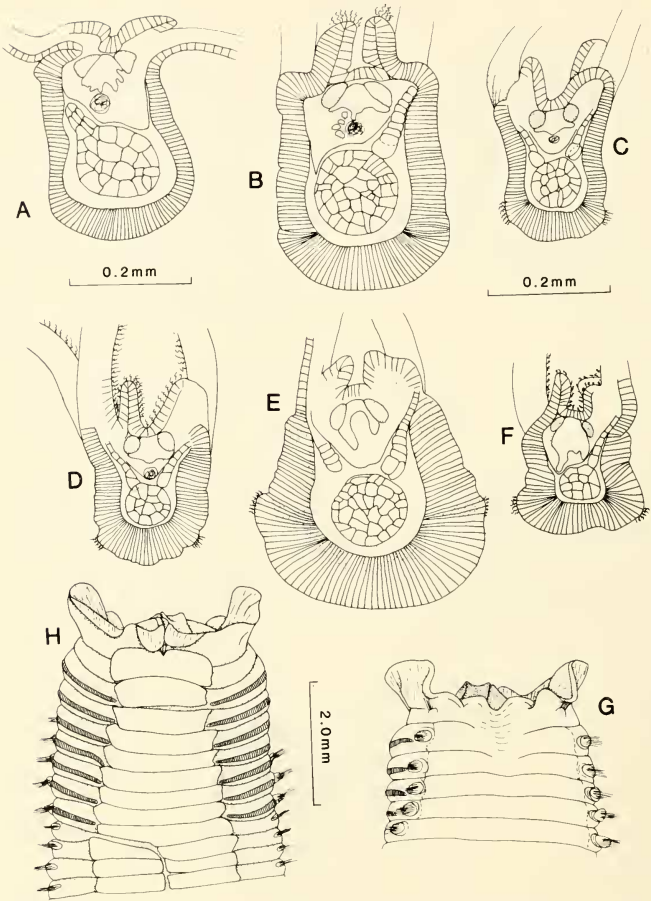


Fig. 12. *Demonax medius*: A-F, Cross sections of radioles (A, Proximal part; B, Middle part; C, Proximal part; D, Middle part; E, From large specimen; F, From small specimen); G, Anterior end of body of holotype of *Parasabella media*, dorsal view; H, Same, ventral view (A, B, YPM 2692; C, D, YPM 2775; E, F, USNM 40322).

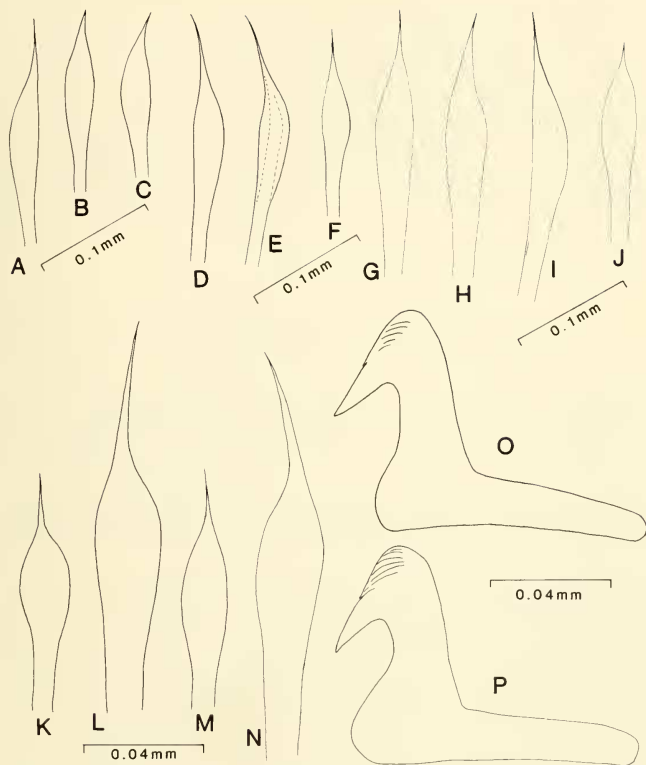


Fig. 13. *Demonax medius*: A–N, Lower thoracic setae (A, Upper, anterior row; B, Lower, anterior row; C, Same; D, Upper, posterior row; E, Same; F, Lower, posterior row; K, Upper, anterior row, small specimen; L, Lower, small specimen; M, Upper, anterior row, juvenile specimen; N, Upper, posterior row, juvenile specimen); O, P, Thoracic avicular hooks (A–F, O, YPM 2691; G, H, USNM 17119; I, J, USNM 41502; K, L, USNM 40332; M, N, USNM 44854; P, YPM 2775).

then reduced in number toward tips; sheaths thicker proximally, basal pinnular skeletal cells slightly flattened, gradually narrower and longer distally. Dorsal lips (Fig. 11A–C, E) fused for most of their basal lengths with upper part of branchial lobes, mostly directed ventrally, then turned anteriorly, broad basally, long, tapered, with radiolar appendage functioning as midrib, joined at margin of upper lamella with 1–2 pinnules (pinnular appendages) of first dorsal radioles, fused pinnules much longer, broader than others, other pinnules diminishing distally.

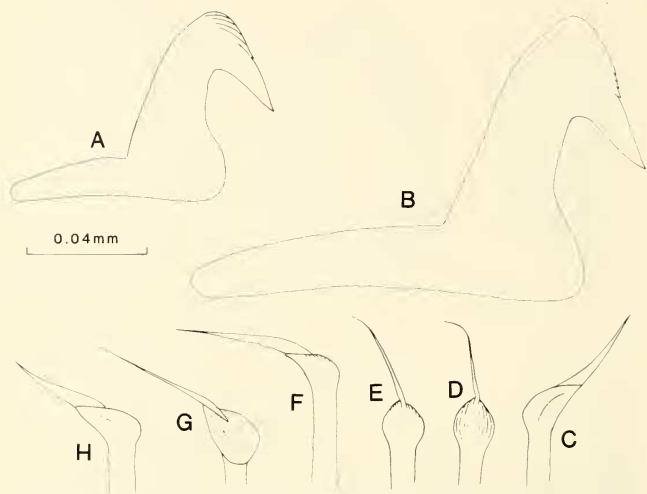


Fig. 14. *Demonax medius*: A, Thoracic avicular hook, small specimen; B, Same, large specimen; C–H, Companion setae (A, USNM 40332; B, G, H, USNM 41502; C–E, YPM 2691; F, YPM 2775).

Usually 8 thoracic setigers (apparent regenerating specimens may have fewer). Collar (Fig. 12G, H) extending past fused bases of branchial crown to beginning of radioles. Ventral shield of collar segment rectangular, greater than 3 times wider than long, incised anteromedially; other thoracic ventral shields trapezoidal with broader anterior margins; shields gradually wider posteriorly. Upper thoracic setae slender, narrowly hooded; lower setae (Fig. 13A–N) broadly hooded, all similar on adults, moderately short, with hooded part including tip about twice broader than shaft and 5–7 times longer than broad. Thoracic tori long, with numerous avicular hooks and companion setae, extending from notopodia to ventral shields; avicular hooks (Figs. 13O, P; 14A, B) of large adults with long handles; companion setae (Fig. 14C–H) with long, slender shafts $1\frac{1}{2}$ length of bases of avicular hooks, with avicular tips, with slender, tapered mucros extending from narrow part of middle of outer margin.

Remarks.—All specimens that I have examined from British Columbia originally identified by Berkeley and Berkeley (1952:112) as *Distylia rugosa* Moore and later changed to *Sabella (Demonax) media* by Banse (1979:878–880) are *Demonax medius*. Other specimens identified by Berkeley and Berkeley (1952) as *Demonax medius* and changed to *Sabella (Demonax) media* by Banse, with the possible exception of one lot (USNM 41464), are *D. rugosus* (Moore).

Bush's (1905) figures of lower thoracic setae are incorrect. Those on the types are actually much slenderer (Fig. 13A–N). Bush's figures of lower thoracic setae

are, in fact, very similar to those I have provided for *D. pallidus* (Moore) (Fig. 16A–D). However, radioles of *D. pallidus* have skeletons in cross section composed of about ten thick-walled cells (Fig. 15B–E), whereas skeletal cells in cross section are much more numerous in *D. medius* and *D. rugosus*.

Juvenile specimens of the above three species are similar and difficult to separate. All have radioles arranged in semicircles and lower thoracic setae which are not diagnostic. The collars of such specimens, however, appear to be similar to those of adults, with that of *D. rugosus* being short.

Demonax medius is here reported from the eastern Pacific Ocean from Alaska south to Monterey Bay, California.

Demonax pallidus (Moore, 1923), new combination

Figs. 15, 16

Parasabella pallida Moore, 1923:241, 242.—Loi, 1980:144.

Sabella media.—Hartman, 1944:285 [in part, not pl. 23, fig. 42].

Demonax medius.—Hartman, 1969:675, 676 [in part, not figs. 1–5].

Material examined.—CALIFORNIA: Off Santa Cruz Lighthouse, Monterey Bay, fine grey sand and rock, 18 m, Albatross sta 4496, 19 May 1904, holotype (USNM 17360). Scorpion Harbor, Santa Cruz Is., coll., W. G. Hewatt, 1 Jul 1939, 1 specimen (identified as *Demonax leucaspis* by Berkeley and Berkeley; USNM 41463). Los Angeles Harbor, coll., V. L. Human, 1 specimen (USNM 49795).

Description.—Tube unknown. Holotype completely without color markings; body 10 mm long, 1.5 mm wide, branchial crown about 4 mm long, 12–13 pairs of radioles with naked tongue-like tips about 1 mm long (Fig. 15A). Other specimens with faint, light brown color spots on radioles, slightly larger, body up to 13 mm long, 2.7 mm wide, branchial crown up to 7.5 mm long with 14–16 pairs of radioles with proportionately shorter tips. Eight thoracic and about 50 abdominal setigers; largest specimen (USNM 41463) apparently regenerating posteriorly, with about 40 abdominal setigers. Radioles in semicircular arrangement, with long, slender pinnules, with rachis in cross section (Fig. 15B–E) having outer corners rounded. Ciliated band not observed. Skeleton consisting of 8–10 irregularly arranged, thick-walled cells; holotype with columnar epithelium poorly preserved, with small skeleton surrounded by thin sheath and thick columnar epithelium; skeleton of largest specimen relatively larger, surrounded by thick sheath and thinner columnar epithelium. Dorsal lips (Fig. 15F) with single pinnular appendage, with radiolar appendages on largest specimen slightly longer than figured. Collar beginning dorsally about midway between collar setae and middorsal line, straight laterally, slightly elongated ventrally as pair of short, pointed lobes at ventral incision, moderately long and extending past basal fused part of branchial crown to beginning of radioles. Thoracic ventral shields almost identical with those of *Demonax medius* (Bush) (Fig. 12H). Posterior dorsum of large specimen (USNM 41463) rugose as on *D. medius* and *D. rugosus*. Lower thoracic setae (Fig. 16A–D) of adults with very short hooded region and long mucronate tip about half total length of remainder of hooded region, with hooded region, including tip, 3–4 times longer than wide and greater than 2 times wider than shaft; blades broader and shorter in anterior parts of bundles. Thoracic

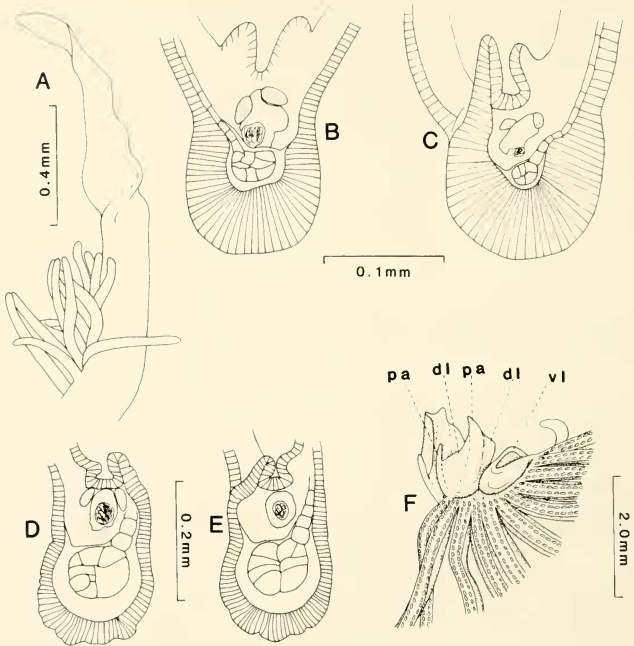


Fig. 15. *Demonax pallidus*: A, Tip of second dorsal radiole; B-E, Cross sections of radioles (B, Proximal; C, Middle; D, E, From middle of proximal half); F, Branchial crown, proximal part, lateral view of dorsal lips, ventral lips, and medial view of radioles (A-C, F, Holotype; D, E, USNM 41463).

avicular hooks (Fig. 16E-H) moderately stout, with handles of moderate length, accompanied by similar number of companion setae (Fig. 16I-L), in long rows from notopodia to ventral shields.

Remarks.—The holotype of *Parasabella pallida* is a subadult specimen as indicated by developing radioles on lower parts of the branchial crown. Lower thoracic setae of small specimens of *Demonax* often have relatively longer points than those on adults of the same species. However, the width of the hooded area compared with that of the shaft is reasonably constant in all specimens irrespective of size. I found only a single lower thoracic seta on the holotype, and it had a broken tip. The seta is similar to those of the posterior part of the bundle of setiger 7 of an adult specimen (USNM 41464). Other lower thoracic setae of the adult are much broader. Further, Moore (1923) stated that notosetae of *D. pallidus* were similar to those incorrectly described for *D. medius* by Bush (1905), also indicating that they had broad blades compared with widths of shafts. As indicated in my description, lower thoracic setae of *D. medius* have a much slenderer blade

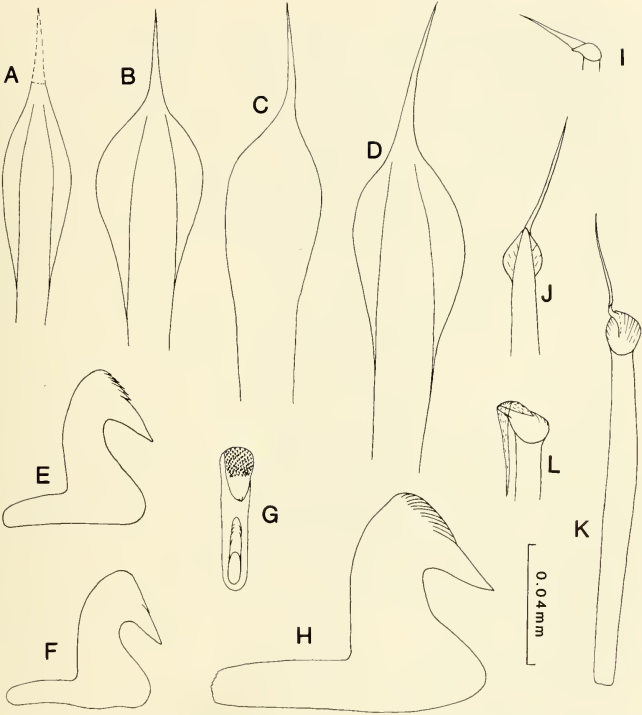


Fig. 16. *Demonax pallidus*: A–D, Lower thoracic setae (B, Upper, anterior row; C, Upper, posterior row; D, Lower, posterior row); E–H, Thoracic avicular hooks (E, F, H, lateral view; G, face view); I–L, Companion setae (A, E–G, I, Holotype; B–D, H, J–L, Large specimen, USNM 41463).

than originally described. Finally, radioles of the holotype and other specimens of *D. pallidus* have a skeleton of 10 or fewer cells in cross section also differing from specimens of *D. medius* to which the species had been referred by Hartman (1944). Difference in thickness of columnar epithelium of radioles between the holotype and other specimens is probably the result of poor preservation and the subadult status of the holotype.

Demonax jamaicensis (Augener, 1924)
Fig. 17

Parasabella jamaicensis Augener, 1924:48.
Demonax jamaicensis.—Johansson, 1927:136.
Sabella jamaicensis.—Hartman, 1959:560.

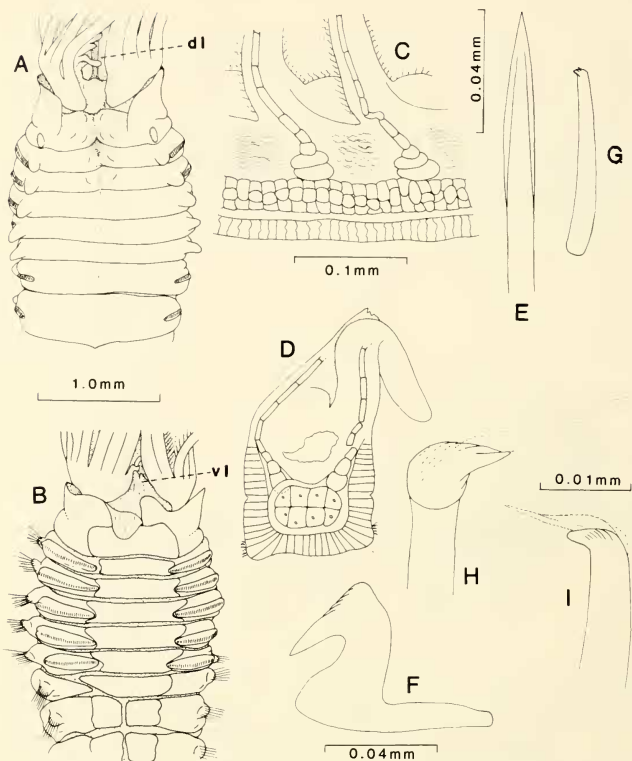


Fig. 17. *Demonax jamaicensis*: A, Anterior end of body and part of branchial crown, dorsal view; B, Same, ventral view; C, Internal structure of radiole, sagittal (lateral) view; D, Cross section of radiole; E, Lower thoracic seta; F, Thoracic avicular hook; G, Thoracic companion seta, mucro missing; H, I, Same, magnified, mucro present (G, Not scaled).

Material examined.—JAMAICA: Holotype, Kingston, (ZMH V-6791).

Description.—Tube rigid, formed of silicate sand grains cemented in yellow translucent matrix, giving overall orange color (mostly covered by sponge). Body ocher-yellow; branchial crown with about 5 crossbands on pinnules and partially on radioles; retained coloration of radioles faint. Branchial crown about 5.5 mm long, body about 13 mm long and 1.5 mm wide at thorax, with 6 thoracic and 25 abdominal setigers [Augener (1924) stated that there were 56 abdominal segments on an animal 13 mm long]; thorax somewhat flattened, with short segments;

abdomen cylindrical, with more elongate segments. Branchial lobes fused proximally for short length, with fused region extending well past collar (Fig. 17A, B). Dorsal and ventral lips of branchial crown not observed. Radioles numbering 10 pairs; ventral pair shorter, $\frac{1}{3}$ length of others on left lobe, vestigial on right lobe (Fig. 17B); in sagittal view (Fig. 17C), pinnular skeleton of radioles showing 2 large, oval cells proximally, with basal cell not recessed into skeleton; nearly rectangular in cross section (Fig. 17D) with angular outer corners; radiolar skeleton oval, with 2 rows of skeletal cells of 4 cells each; radiolar sheath moderately thick, surrounded by moderately thick columnar epithelium; ciliated bands present on radioles below outer lateral corners. Collar short, widely separated dorsally, beginning slightly anterior and medial to collar setae, concave ventrolaterally, changing to 2 moderately long, rounded lappets at ventral incision (Fig. 17B). Thorax with slight medial furrow on anterior 2–3 segments. Notopodia on conical lobes; tori extending from notopodia to ventral shields. Ventral shield of collar segment rectangular, about twice wider than long and broader than those following; other thoracic ventral shields gradually wider and longer, rectangular to trapezoidal with broader anterior margins; those after setiger 3 with lateral sides concavely curved around lower parts of tori. Collar setae numbering about 17, slender, in 2 short rows or elongate-oval group; other thoracic segments with upper arc of narrowly hooded setae and 2 lower transverse rows of shorter setae with hooded area only very slightly broader than shaft (Fig. 17E); about 18 lower setae on setiger 2, fewer on more posterior thoracic segments. Thoracic avicular hooks (Fig. 17F) with slender, long handles, numbering about 42 on setiger 2, 38 on setiger 4. Companion setae (Fig. 17G–I) with shaft very stout basally, very slightly bent, gradually tapered from base to tip, head not much broader than shaft, mucro extending from middle of entire length of beak and ending in long, pointed tip. Abdominal tori with about 20 avicular hooks similar to those of thorax but with much shorter handles; abdominal setae about 19 in each bundle, hooded, similar to upper thoracic setae, arranged in 2 transverse rows.

Remarks.—The species is known only from the original report of Augener (1924). The holotype may have been regenerating the anterior end as indicated by the reduced number of thoracic segments; it does not appear to be a juvenile. I did not examine the dorsal and ventral lips; the specimen was returned to the Zoologisches Museum, Hamburg, before the necessity to do so became apparent to me. However, *Parasabella jamaicensis* appears to be a *Demonax*, closely related to *D. microphthalmus* (Verrill).

Demonax lacunosus, new species
Figs. 18–20

Material examined.—FLORIDA: Hutchinson Island, sta V, 27°22.9'N, 80°13.9'W, 11 m, coarse calcareous sand, coll., Gallagher, Jul 1973, holotype (USNM 54725), 3 paratypes (USNM 60897; FSBC I 23792).

Description.—Tubes lost. Branchial crown of large specimen (Fig. 18A; USNM 60897) with yellowish brown pigment spots on outer, lateral margins of radioles and extending onto pinnules, spiraling anteriorly from dorsal to ventral sides in about 7 bands; distal pigment spots more prominent and appearing in more irregular arrangement; smaller specimens, including holotype, with indistinct pig-

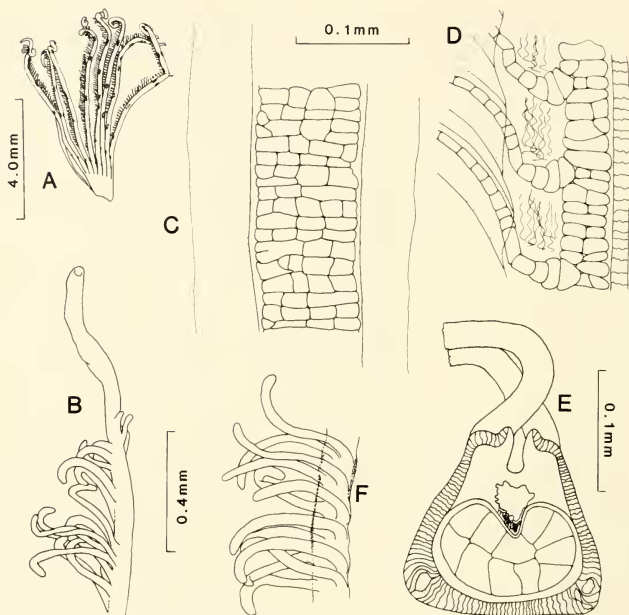


Fig. 18. *Demonax lacunosus*, large paratype (USNM 60879): A, Detached branchial crown, view from left side; B, Tip of radiole; C, Internal structure of radiole, frontal view; D, Same, sagittal (lateral) view; E, Cross section of radiole; F, Middle of radiole.

ment spots proximally, prominent ones distally; eyespots absent. Pygidium with paired, red eyespots. Large specimen (damaged, apparently regenerating posterior end) with body 10 mm long, 1.4 mm wide; branchial crown 7 mm long; 8 thoracic and 27 abdominal setigers. Holotype of 8 thoracic setigers (7 on right side), 33 abdominal setigers; body 3.1 mm long, branchial crown 2.5 mm long. Large specimen with 10 pairs of radioles and additional, vestigial pair ventrally; smaller specimens with 6–7 pairs of radioles; branchial lobes fused proximally for short length; radioles with short, tongue-shaped distal ends without pinnules (Fig. 18B). Radioles in frontal view (Fig. 18C) with broad skeleton of cartilaginous cells organized in irregular transverse rows of 3–5 cells; broad columnar epithelium laterally; elongate, oval pigment spots on outer lateral margins, more distally on borders away from dorsal midline; empty spaces usually visible in columnar epithelium near lateral margins. In sagittal view (Fig. 18D), basal pinnular skeletal cells deeply recessed into radiolar skeleton at angle of 90–120°. Radioles in cross section view (Fig. 18E) trapezoidal, much broader on outer margin than at at-

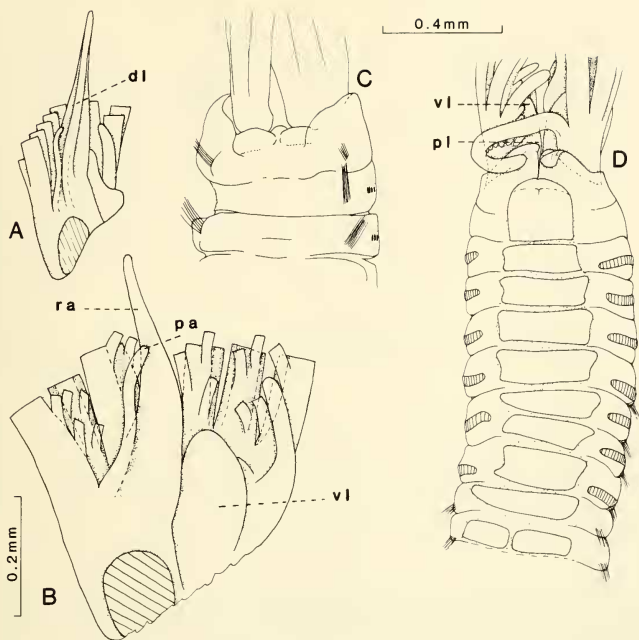


Fig. 19. *Demonax lacunosus*: A, Left side of branchial crown, medial view, most of radioles omitted; B, Same; C, Anterior end of body and part of branchial crown, dorsal view; D, Same, ventral view (A, Large paratype, USNM 60879; B, Small paratype, FSBC I 23792; C, Small paratype; D, Holotype; A, Not scaled).

tachment of pinnules; outer lateral corners almost angular, probably angular in life; skeleton reniform in outline, formed of 8–11 cells, surrounded by thin sheath and moderately thin columnar epithelium; epithelium with cavities in outer lateral corners surrounded by epithelial cells (or with highly vacuolate cells); outer lateral corners with obscure rows of cilia (visible on holotype but not on large specimen). Pinnules short, widely spaced and not more than 3 times longer than thickness of radioles (Fig. 18F). Dorsal lips (Fig. 19A, B) slender, about $\frac{1}{4}$ length of radioles, elongate-triangular, fused on basal $\frac{2}{3}$ of upper margin with modified pinnules of first dorsal radiole (pinnular appendage). Ventral lips extending $\frac{1}{3}$ of length of dorsal lips. Collar short (Fig. 19C, D), extending for about half length of fused, cartilaginous base of branchial crown, widely separated dorsally, beginning about half distance from dorsal midline to collar setae, not notched but concave laterally, ending at ventral incision in long, triangular lappets. Dorsum of thorax with small,

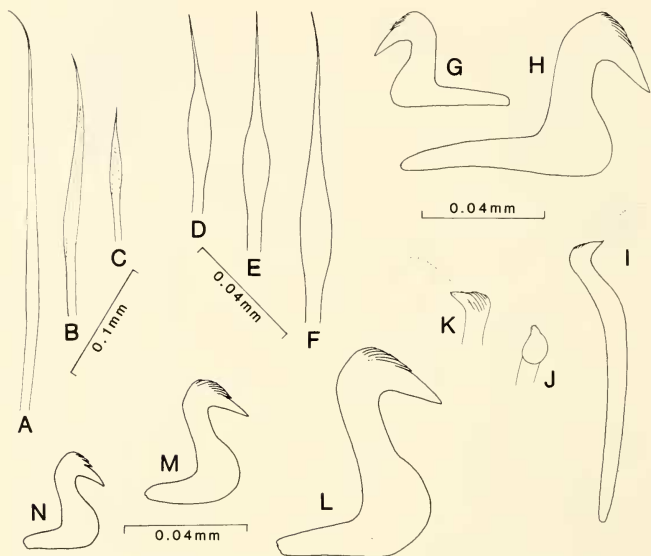


Fig. 20. *Demonax lacunosus*: A, Upper thoracic seta; B-F, Lower thoracic setae (B, Posterior row; C, Anterior row; D, Upper, anterior row; E, Upper, posterior row; F, Lower, posterior row); G, Thoracic avicular hook from lower part of torus, setiger 2; H, Same, from upper part of torus; I-K, Companion setae; L-N, Abdominal avicular hooks (L, From lower part of bundle; M, N, From upper part of bundle) (A-C, G-N, Large paratype, USNM 60879; D-F Holotype).

anterior, medial groove; ventral shield of collar segment about as long as wide, pentagonal with broader posterior margin or rectangular with rounded anterior margin (Fig. 19D); remaining thoracic ventral shields rectangular but slightly concave laterally, greater than twice broader than long on small specimens, longer than broad on large specimen; neuropodial tori of thorax well separated from ventral shields. Collar segment with 2 short rows of narrowly hooded setae, hooded parts on those of upper row longer by ratio of 10:7 and similar to upper setae of setigers 2-8; setae of setigers 2-8 (Fig. 20A-F) with arc of long, very slender setae above notopodial lobe, elongate-oval group or 2 transverse rows of shorter, slender, more broadly hooded setae below; latter type with hooded parts including tips 9-13 times longer than wide, slightly less than twice broader than shafts, shorter by $\frac{1}{2}$ on anterior row than on posterior row on large specimen, slightly less so on smaller specimens. Thoracic tori with about 36 pairs of avicular hooks and companion setae on setiger 2 of large specimen, diminishing in number posteriorly; avicular hooks (Fig. 20G, H) slender, with handles of moderate length; companion setae (Fig. 20I-K) with slender shafts, denticulate, avicular heads

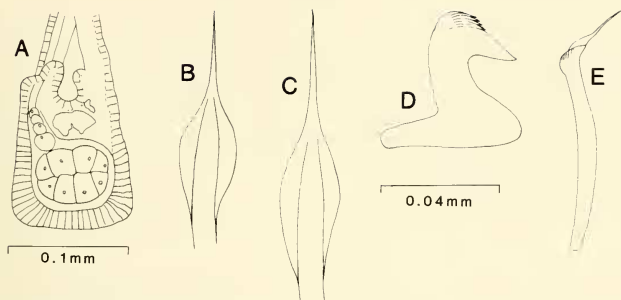


Fig. 21. *Demonax* sp.: A, Cross section of radiole; B, C, Lower thoracic setae (B, Lower, anterior row; C, Middle, posterior row); D, Thoracic avicular hook; E, Companion seta.

slightly broader than widest part of shaft, and long, tapered hyaline mucro extending from complete length and most of width of beaked part. Abdominal setae slender, hooded, in 2 transverse rows or elongate-oval group. Abdominal avicular hooks similar to those of thorax but with much shorter handles and relatively longer necks (Fig. 20L–N), with about 23 hooks in tori of first abdominal setiger of large specimen, diminishing in number posteriorly and in size from lower to upper parts of tori.

Remarks.—*Demonax lacunosus* is a small species and differs from most other members of the genus in the following characters: 1) the branchial crown is more than half as long as the body; 2) radioles are nearly trapezoidal in cross section, with a large skeleton, thin sheath, and moderately thin columnar epithelium with spaces in the outer lateral corners; 3) dorsal lips are very slender; 4) the two rows of collar setae are of distinctly unequal lengths; 5) the ventral shield of the collar segment is about as long or longer than wide; and 6) thoracic tori do not extend to the ventral shields. *Demonax lacunosus* differs from *D. japonicus*, to which it appears to be closely related, in having up to 10 rather than 15 pairs of radioles.

Etymology.—The specific name is derived from the Latin and refers to the spaces in the outer lateral corners of the radioles.

Demonax sp.

Fig. 21

Material examined.—BAHAMA ISLANDS: Lucaya, near Freeport, Grand Bahama Is., on jetty, about 1.5 m, coll., W. Jaap and Sylvia Earle, 7 Apr 1974, 1 specimen (FSBC I 24195).

Description.—Tube absent. Body 8 mm long, about 1 mm wide across thorax; 7 thoracic and 23 abdominal segments plus 1 mm long, regenerating posterior end. Branchial crown with about 7 reddish-brown cross bands, without eyespots, with 9 pairs of radioles in semicircular arrangement; radioles in cross section (Fig. 21A) with somewhat rounded outer lateral corners, with moderately large, oval

skeleton of 8–10 cells, without prominent ciliated bands; dorsal lips similar to those of *D. microphthalmus*. Collar well separated dorsally, moderately long, straight laterally, ending at ventral incision in triangular lappets. Ventral shield of collar segment short, about 3 times broader than long, slightly longer than those following, incised anteromedially; other thoracic ventral shields narrower, trapezoidal, with broader margin anterior; shields gradually narrower posteriorly. Setae and uncini (Fig. 21B–E) similar to those of *D. microphthalmus* but lower thoracic setae with hooded parts about $2\frac{1}{2}$ times broader than shafts and, including tips, 4–5 times longer than broad.

Remarks.—As indicated in the key, this small, subadult specimen closely resembles *D. pallidus* (Moore). It does not appear to be a juvenile of *D. microphthalmus*, a species widely distributed on the east coast of the Americas from Massachusetts to Colombia. Juvenile specimens of *D. microphthalmus* have lower thoracic notosetae with long, drawn-out points, but with hooded parts only about twice as wide as shafts (Fig. 7H, I), and the ventral shield of the collar segment of juvenile *D. microphthalmus* is much longer.

Hypsicomus Grube, 1870

Hypsicomus Grube, 1870:348.

Type-species.—*Sabella stichophthalmos* Grube, 1863; subsequent designation by Bush (1905:191).

Grube (1870) originally included the following four species in *Hypsicomus*: *Sabella stichophthalmos*; *S. alticollis* Grube, 1868; *S. brevicollaris* Grube, 1858; and *S. simplex* Grube, 1870. *Sabella stichophthalmos* does not conform to the original diagnosis that Grube gave for the genus, because collar setae are arranged not in a long row but in a short one, the collar is not a low ring but four-lobed, and the basal lamina is not unusually high. Nevertheless, the species was correctly designated as the type-species of *Hypsicomus* in accordance with Article 69 of the International Code of Zoological Nomenclature (1964). Augener's later (1924) designation of *Sabella phaeotaenia* Schmarda, 1861, as the type-species, which was not one of the species included in *Hypsicomus* by Grube (1870) but which was followed by Hartman (1959) and several others, most yield to the earlier designation by Bush. I have seen Grube's original descriptions of *S. simplex*, *S. alticollis*, and *S. brevicollaris*, Schmarda's original description of *S. phaeotaenia*, and examined a specimen of *S. brevicollaris* identified by Grube; in my opinion, all are species of *Notaulax* Tauber, below.

Diagnosis.—Radioles in semicircular to slightly spiraled arrangement, joined proximally by palmate membrane for $\frac{1}{4}$ to $\frac{1}{3}$ of their length, without stylodes, with punctate, lensed ocelli on lateral margins distal to palmate membrane, with flanges on outer lateral corners near tips, and with medial flanges on upper pair in region of palmate membrane; branchial crown without flanges proximally on upper and lower parts of fused, cartilaginous base. Dorsal lips beginning ventrally near ventral margin of branchial lobes, long, slender, with radiolar appendage functioning as midrib joined dorsally to base of first dorsal radiole by lamella, without pinnular appendages. Ventral lips reduced; ventral sacs present. Prostomium long. Two pairs of accessory lamellae on prostomium-collar segment, including pair of auriculate lamellae on dorsum of prostomium originating dorso-

laterally, curved medially, and pair of collar-like lamellae beginning on anteromedial margin of prostomium, extending straight laterally, ending ventrally under ventral lappets of collar, or slightly more anterior, below or partially covering ventral sacs. Collar with dorsal origins widely separated, incised laterally and ventrally. Collar setae in short bundles or 2 short rows, slender, narrowly hooded, similar to upper setae of other thoracic segments. Setae of other thoracic segments consisting of upper arc of slender, hooded setae above 2 transverse rows or transverse, elongate group of paleate setae. Thoracic avicular hooks with handles of moderate length; companion setae with broad, thin, pennonate blades at right angles to shafts. Abdominal setae, including mucronate paleae and slender capillaries, in short, transverse rows; avicular hooks similar to those of thorax but with shorter handles.

Remarks.—*Hypsicomus stichophthalmos* was reported as *Sabella* (*Potamilla*) *stichophthalmos* from Madeira by Langerhans (1884) and later referred to *Potamilla* Malmgren by Fauvel (1927). About the only important character in common between *H. stichophthalmos* and *Potamilla neglecta* (Sars, 1850), the type-species of *Potamilla*, is the presence of paleae on the lower parts of thoracic notopodia. Among other characters, *Potamilla* has dorsal lips without radiolar appendages and hooded setae of one type but of greatly different lengths in the abdomen, whereas *Hypsicomus* has dorsal lips with radiolar appendages and two types of setae in the abdomen, slender capillaries and mucronate paleae.

Anamobaea Krøyer, 1856, an older name with type-species *A. orstedii* Krøyer, is similar to *Hypsicomus* in having similar setae and uncini, branchial crown, and collar. However, the two pairs of accessory lamellae on the prostomium-collar segment region of *Hypsicomus* are not present on *A. orstedii*, the only known species in the genus, and the latter has branchial lobes with broad flanges proximally on the upper and lower margins in the region of a long basal lamina, both of which are absent on *Hypsicomus*.

Potamethus Chamberlin, 1919, with type-species *Potamis spathiferus* Ehlers, 1887, is similar to *Hypsicomus* in having two types of setae on abdominal segments, a long prostomium-collar segment region and similar setae on thoracic setigers. However, both a definite palmate membrane and lensed ocelli are absent from the branchial crown of *Potamethus*, and thoracic neuropodia of *Potamethus* have avicular hooks and companion setae with very long handles. *Potamethus dubius* (Eliason, 1951) has accessory lamellae on the ventrum of the prostomium-collar segment region which appear to be similar to the lateroventral accessory lamellae of *H. stichophthalmos*.

Hypsicomus stichophthalmos (Grube, 1863)

Figs. 22, 23

Sabella stichophthalmos Grube, 1863:62, 63, pl. 6, fig. 3.—Wiktor, 1980:281 [report of syntype].

?*Sabella stichophthalmos*.—Marion and Bobretzky 1875:92, 93, pl. 11, figs. 23a–g.

Sabella (*Hypsicomus*) *stichophthalmos*.—Grube, 1870:348.

?*Sabella* (*Potamilla*) *stichophthalmos*.—Langerhans, 1884:267.

?*Hypsicomus caecus* Iroso, 1921:70, 71.

Potamilla stichophthalmos.—Fauvel, 1927:311, 312 [in part; fig. 106k; not *P. stichophthalmos* of Fauvel, 1914a:315, 316, pl. 31, figs. 30–35].

Material examined.—YUGOSLAVIA: Crivizza, Lussin [Losinj] Is., Adriatic Sea, 8 syntypes (ZMB 372, ZMB Q 5240).

Description.—Tube (Fig. 22A) with smooth, thick covering of grey silt, free part fragile, embedded part horny, reddish-orange. Body 36 mm long, 2 mm wide (Grube 1863), up to 190 segments; branchial crown 11 mm long. Branchial lobes with 13–16 pairs of radioles united by palmate membrane (Fig. 22A) for $\frac{1}{5}$ – $\frac{1}{4}$ their length, with moderately long, fused region proximally; radioles with outer lateral corners rectangular proximally, flanged near tips; tips long, cylindrical; skeleton in cross section of 4 cells surrounded by thick sheath and columnar epithelium (Fig. 23A); ciliated bands absent. Dorsal lips (Fig. 23B) $\frac{1}{4}$ length of radioles, long, slender, with upper lamella “Z” shaped, ventral lips reduced or absent (looked for but not observed). Prostomium anteriorly pointed on dorsal side; auricular lamellae on dorsum of prostomium bent medially; lateroventral prostomial-peristomial lamellae under collar slightly prolonged ventrally, forming triangular lappets. Ventral collar lamellae (Fig. 22C, D) extending to beginning of branchial crown, with rounded tips; dorsolateral lamellae extending less than half as far, beginning dorsally above collar setae, extending anteriorly to posterior margins of auricular lamellae of prostomium with dorsal margins about twice longer than ventral ones (Fig. 22A, B). Nine to 13 thoracic setigers. Ventral shield of collar segment (Fig. 22C, D) rectangular posteriorly, broadened and rounded anteriorly, deeply incised anteromedially, often divided by transverse furrow; ventral shields of other thoracic segments rectangular. Collar setae slender (Fig. 23C), with blades about twice longer on medial than on lateral row, otherwise similar. Upper setae of other thoracic setigers (Fig. 23D) similar to long ones of collar segment; lower paleate setae arranged in 2 transverse rows (Fig. 23E–G), some with slender mucronate tips. Thoracic avicular hooks in moderately long rows not extending to ventral shields (Fig. 23H), with broad handles of moderate length; companion setae (Fig. 23I–K) with long, thin, slender, pennonate blades extending from entire surface of head, ending in symmetrical tips. Abdominal avicular hooks (Fig. 23L) with handles shorter than those of thorax; setae consisting of slender capillaries and mucronate paleae with asymmetrical tips in 2 short, transverse rows (Fig. 23M).

Remarks.—*Hypsicomus stichophthalmos* may have been confused with one or more other species from the time of its original description. A syntype lot (ZMB Q 5240) contains eight specimens of *H. stichophthalmos* and one specimen of another species which appears to be related to *Pseudopotamilla* Bush. The latter specimen has avicular hooks of thoracic setigers with extremely long rather than moderately long to long handles, and punctate, lensed ocelli scattered along the sides of radioles rather than circular, composite eyes on the outer surface as on *P. reniformis*, the type-species of *Pseudopotamilla*.

Fauvel's (1927) description of *Potamilla stichophthalmos* contains the original figure of Grube and also figures of another species from the Cape Verde Islands which he mistakenly reported under the same name. Bellan (1964) also may have included two species in his account of *Potamilla stichophthalmos* from the Mediterranean, because he described two types of tubes.

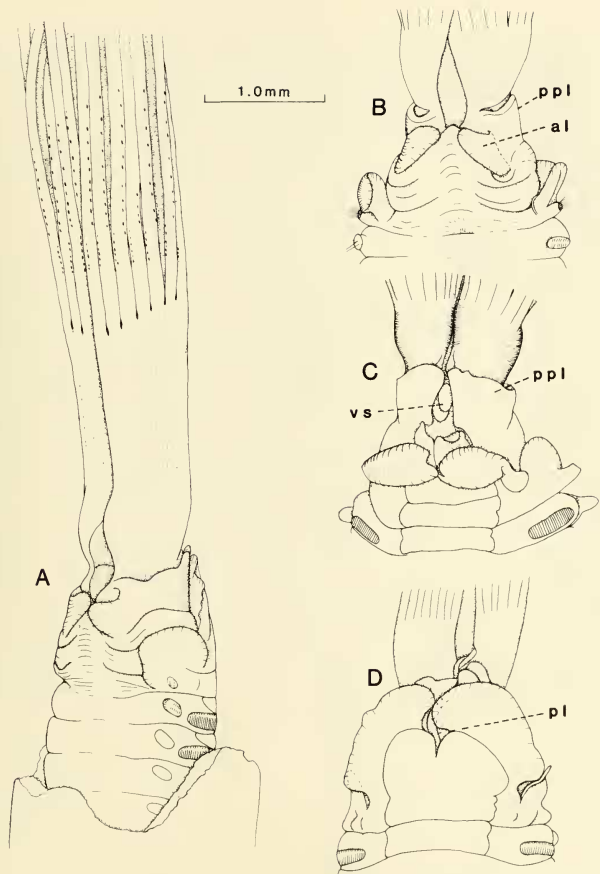


Fig. 22. *Hypsicomus stichophthalmos*, syntypes (ZMB Q 5240): A, Tube, anterior end of body and about half of branchial crown, dorsolateral view; B–D, Anterior end of body and part of branchial crown (B, Dorsal view; C, Ventral view, ventral lappets of collar folded back; D, Ventral view, ventral lappets of collar extended).

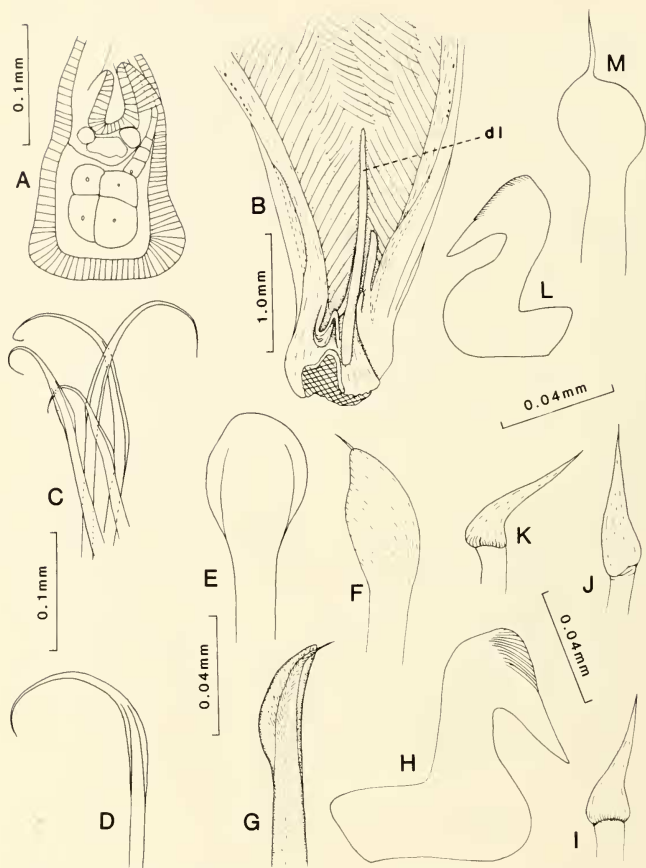


Fig. 23. *Hypsicomus stichophthalmos*, syntypes (ZMB Q 5240): A, Cross section from proximal half of radiole; B, Left half of branchial crown, proximal part, medial view, left side is dorsal; C, Collar setae; D, Upper thoracic seta; E-G, Lower thoracic setae (E, Medial view, concave side; F, Outer, lateral side, turned; G, Sagittal view); H, Thoracic avicular hook; I-K, Companion setae; L, Abdominal avicular hook; M, Abdominal paleate seta.

Hypsicomus stichophthalmos is known from the Adriatic Sea and possibly from Gulf of Marseille and Madeira; I cannot confirm from their descriptions that the records of Marion and Bobretzky (1875) and Langerhans (1884), respectively, actually were *H. stichophthalmos*.

Notaulax Tauber, 1879

Hypsicomus Grube, 1870:348 [in part; not *Sabella stichophthalmos* Grube].—Marenzeller, 1884:211 [in part].—Johansson, 1927:137 [in part].—Fauvel, 1927:312.—Hartman, 1959:546, 547 [in part]; 1965a:77.—Hartmann-Schröder, 1971:502.—Fauchald, 1977a:139 [in part].

Notaulax Tauber, 1879:136.—Levinsen, 1883:185, 187, 188.

Protulides Webster, 1884:325.

Eurato Saint-Joseph, 1894:219, 220.

Hypsicomatopsis Augener, 1924:49.

Type-species.—*Notaulax* n. sp. Tauber, 1879; = *N. rectangulata* Levinsen, 1883; by monotypy.

Diagnosis.—Radioles in semicircles, joined by palmate membrane for up to about $\frac{1}{3}$ total length (Figs. 27A, 33A), with punctate, lensed ocelli scattered along radioles on lateral margins distal to palmate membrane, or organized into various groups; without stylodes; with flanges on outer lateral corners at least distally (Fig. 28B–D); skeleton in cross section consisting of 4, rarely 5, cells. Dorsal lips (Fig. 27C) long, slender, with radiolar appendage forming midrib, joined by short lamella with base of first dorsal radiole, without pinnular appendages. Ventral lips rather small, beginning ventrally below collar, folded and joining branchial lobes near origin of first ventral radiole; ventral sacs absent. Branchial lobes with long, smooth, basal lamina overlying prostomium proximal to origins of radioles; basal lamina with broad, overlapping flanges on both dorsal and ventral margins, extending to origins of radioles. Collar entire to 4-lobed. Eight or more thoracic setigers. Ventral shield of collar segment short, nearly rectangular, usually with golden-brown bar on anterior margin; other thoracic ventral shields longer, with anterior margins usually broader than posterior ones, concavely curved laterally around tori; posterior thoracic ventral shields often dark brown; abdominal ventral shields rectangular, usually dark brown. Collar setae short, spine-like, in long, longitudinal to oblique, often sinuate rows. Other thoracic setae including stout, spine-like setae in arc above 2 oblique rows of stout paleae; paleae often with minute mucros; avicular hooks with broad handles of moderate length; companion setae with broad, thin, teardrop-shaped blades at right angle to shafts. Abdominal hooks with handles shorter than those of thorax, in short tori; setae in short transverse rows consisting of paleae and capillary setae; paleae with long mucros.

Remarks.—Species in this genus form a very homogeneous group. *Sabella stichophthalmos* Grube, 1863, and *Anamobaea orstedii*, Krøyer, 1856, included in *Hypsicomus* by Johansson (1927) and Hartman (1959), are not members of *Notaulax* because they have collar setae in a bunch or short oval group. *Sabella stichophthalmos* is included in this report as the type-species of *Hypsicomus*; *Hypsicomus caecus* Iroso, 1921, from the Bay of Naples, described in a very brief account without figures, may be synonymous with *H. stichophthalmos* or possibly may be the species similar to *Pseudopotamilla* noted in the syntype lot of that species (ZMB Q 5240).

Nominal species of *Notaulax* which are not included here in systematic accounts either as distinct species or their synonyms are listed in Table 1.

Many of these species have been referred to *Notaulax phaeotaenia* by various authors, including Johansson (1927) and Hartman (1959). Descriptive informa-

Table 1.—Names, original citations, type-localities, and other citations of *Notaulax* species not included in species accounts.

Name	Original citation	Type-locality	Other citations
<i>Sabella phacotaenia</i> Schmarda	1861:35, pl. 22, fig. 188	Ceylon	<i>Hypsicomus phacotaenia</i> . — Augener, 1914: 113–115 [in part, report of types]
<i>Sabella tilosailla</i> Schmarda	1861:34, pl. 23, fig. 191	Chile	
<i>Sabella alticollis</i> Grube	1868:638, 639, pl. 7, fig. 6	Red Sea	<i>Hypsicomus phacotaenia</i> . — Marenzeller, 1884:212, pl. 3, fig. 3 [not <i>S. phacotaenia</i> Schmarda]
<i>Sabella simplex</i> Grube	1870:348, 349	Port du Roi Georges, Mediterranean Sea	
<i>Sabella fuscoteniata</i> Grube	1874:328, 329	Ceylon	<i>Hypsicomus phacotaenia</i> . — Hoagland, 1920: 626 [not <i>S. phacotaenia</i> Schmarda]
<i>Sabella pyrrhogaster</i> Grube	1878:250, 251, pl. 15, fig. 1	Bohol, Philippine Islands	
<i>Sabella velata</i> Haswell	1884:671, 672, pl. 34, fig. 8	Port Jackson, Australia	<i>Hypsicomus phacotaenia</i> . — Augener, 1914: 113–115 [in part, not <i>S. phacotaenia</i> Schmarda]
<i>Hypsicomus circumspiciens</i> Ehlers	1887:271–277, pl. 55, figs. 5–13, pl. 56, figs. 1–3	Carysfort Reef, Florida	
<i>Hypsicomus lyra</i> Moore	Moore and Bush, 1904:161–164, pl. 11, figs. 7–13, pl. 12, fig. 42	Suruga Bay, Japan	
<i>Hypsicomus marenzelleri</i> Gravier	1906a:34–36	Red Sea	Gravier, 1906b: pl. 6, figs. 247–251; 1908:78–81, text-figs. 418–423.
<i>Hypsicomus pigmentatus</i> Gravier	1906a:36, 37	Red Sea	Gravier, 1906b: pl. 6, figs. 252–254; 1908:81–84, text-figs. 424–431
<i>Hypsicomus capensis</i> Day	1961:537, fig. 13,f–m	Agulhas Bank, South Africa	Day, 1967:761, fig. 37.2.a–h
<i>Hypsicomus longithoracalis</i> Hartmann-Schröder	1980:79, 80, figs. 124–129	Port Samson, Australia	

tion indicates that they certainly comprise several species. Descriptions of many are brief, and material of some has been lost. However, an attempt has been made to include as many of these species as possible in the key to species, below, in order to facilitate and encourage further research.

Sabella tilosaula Schmarda and *S. simplex* Grube are not included in the key because of insufficient descriptive information. *Sabella velata* Haswell is not included in the key because descriptions of it and *S. alticollis* Grube indicate that they differ principally in color pattern, and, in the absence of other characters, such a difference is not usually considered to be important. *Sabella phaeotaenia* Schmarda is not included in the key. It appears to be similar to *S. alticollis*. But radiolar ocelli have not been reported for *S. phaeotaenia*. It is likely that ocelli are present, but if so, their arrangement is unknown; it is possible that they had faded by the time Augener (1914) reexamined the types. *Sabella pyrrhogaster* Grube is included in the key with some reservations, because I suspect that the description is incorrect. Grube (1878) stated specifically that ocelli were absent. His description indicates that branchial lobes were damaged on the largest specimen, and it is likely that radiolar ocelli were sloughed off with epidermal tissue or faded. Grube (1878) also reported that only paleae were present in thoracic notopodia of *S. pyrrhogaster* and did not note companion setae. He did not report companion setae on any of the *Notaulax* species he described, but I am not certain what importance should be attributed to the absence of the upper group of thoracic setae; I suspect that such setae are present. Saint-Joseph (1894) included *S. pyrrhogaster* and some other species for which only one type of thoracic notosetae had been reported in his new genus *Eurato*, and Bush (1905) designated it as the type-species of the genus.

Characters of specific importance are the arrangement and position of radiolar ocelli, the shape of the collar, the number of thoracic setigers, the cross sectional structure of the radioles, and pronounced differences in the setae or uncini.

Collars of some species change during development from a 4-lobed structure on juveniles to a 1- or 2-lobed structure on adults. Dorsally, the anterior margin may be completely entire and free from the collar segment, incised medially and immediately merged with the anterior margin of the collar segment forming a dorsal notch, or gradually divergent from the margin well lateral to the midline. The margin of the collar of adults may be ventrally incised, entire, or incised both laterally and ventrally. Only major differences in setation are important. Further, in juveniles of most species, the position and organization of the ocelli are not diagnostic. Therefore, several specimens should be examined before a specific determination is made.

Minute mucros were sometimes observed on the concave side of thoracic notopodial paleae on species for which they have not been previously reported. These were apparently not developed or were broken on other paleae of those species. They may be absent on thoracic paleae of some species.

Key to Some Species of *Notaulax*

1. Collar 4-lobed

– Collar 1- or 2-lobed

2. Thorax with 8 setigers; radiolar ocelli in single rows of about 10
- 2

3
- N. capensis* (Day)

- Thorax with 13 setigers; radiolar ocelli in single rows of up to 50 *N. circumspiciens* (Ehlers)
- 3. Collar margin deeply incised dorsally, separated from collar segment, or joined with collar segment immediately or well lateral to midline 4
- Collar margin entire dorsally, always separated from collar segment .. 13
- 4. Collar margin of adults entire ventrally [may be incised on juvenile specimens] 5
- Collar margin of adults incised ventrally 7
- 5. Radiolar ocelli in single rows *N. rectangulata* Levinsen
- Radiolar ocelli in oval groups 6
- 6. Collar segment about as long as wide, longer than next 3 segments, with rows of collar setae less than $\frac{1}{2}$ segmental length; radioles completely flanged except for small part of ocellar region *N. bahamensis*, n. sp.
- Collar segment wider than long, about as long as next 2 segments, with rows of collar setae more than $\frac{1}{2}$ segmental length; radioles not flanged between palmate membrane and distal part of region of ocelli. *N. nudicollis* (Krøyer)
- 7. Anterior margin of collar joining with collar segment only at midline, or margin deeply incised dorsomedially 8
- Anterior margin of collar joining collar segment well lateral to midline 11
- 8. Thoracic paleae very dissimilar in anterior and posterior rows; those in posterior row having mucros as long as bladed parts *N. lyra* (Moore)
- Thoracic paleae more or less similar in anterior and posterior rows; mucros, if present, much shorter than blades 9
- 9. Radioles with few ocelli, in small groups corresponding to perhaps 4 pinnules in length (Fig. 33F) *N. paucoculata*, n. sp.
- Radiolar ocelli much more numerous, in larger groups corresponding to more than 8 pinnules in length 10
- 10. Dorsal margin of collar incised medially only; groups of ocelli corresponding to 9 pinnules in length, mostly arranged in single rows with a few pairs proximally (Fig. 37A) *Notaulax* sp.
- Dorsal margin of collar incised medially and dorsolaterally; groups of ocelli corresponding to about 15 pinnules in length, arranged in compact group proximally, singly or in pairs distally *N. pigmentata* (Gravier)
- 11. Ocelli numerous, irregularly arranged in long, single rows *N. occidentalis* (Baird)
- Ocelli few, arranged in small groups or short single rows 12
- 12. Dorsolateral and ventromedial regions of collar margin exceeding base of branchial crown; thoracic companion setae with long, slender blades. *N. midoculi* (Hoagland)
- Neither dorsal nor ventral regions of collar margin extending to base of branchial crown; companion setae with very broad, short blades (Fig. 31F-H) *N. californica* (Treadwell)
- 13. Collar margin entire both dorsally and ventrally 14
- Collar margin entire dorsally, incised ventrally 15
- 14. Radiolar ocelli absent; ventral margin of collar produced forward as moderately long, obtuse, triangular lobe *N. pyrrhogaster* (Grube)

- Radiolar ocelli arranged in compact group on each side; groups corresponding to about 7 pinnules in length, in 2 rows, with less than 15 ocelli in each row; ventral margin of collar only slightly produced forward *N. alticollis* (Grube)
- 15. Radiolar ocelli in series of about 30 on each side, extending from just above palmate membrane to near tips *N. fuscotaeniata* (Grube)
- Radiolar ocelli numbering about 20, in compact group corresponding to about 4 pinnules in length *N. marenzelleri* (Gravier)

Notaulax rectangulata Levinsen, 1883
Fig. 24

Notaulax, n. sp. Tauber, 1879:136.
Notaulax rectangulatus Levinsen, 1883:185, 188, pl. 2, figs. 1–3, 8 m, n; 1893: 353.
Hypsicomus rectangulatus.—Johansson, 1927:141.
Hypsicomus sp.—Hartmann-Schröder, 1971:502.

Material examined.—DENMARK: Holotype, Lille Baelt (ZMC).
Description.—Tube coreaceous, covered with black mud (Tauber, 1879). Branchial crown with 12 pairs of radioles; radioles flanged near tips, with single, short row of ocelli (Fig. 24A) at region $\frac{2}{3}$ distance from palmate membrane to tip; ocelli oriented lateroproximally on proximal end, gradually changing to laterodistal orientation at distal end, covering angle of about 140°; collar (Fig. 24B) a single lobe beginning dorsally at midline, curving anterolaterally, then extending in almost straight, transverse line around body to opposite side [whether free or fused at anterior dorsal margin with collar segment unresolved, but apparently similar to that of *N. nudicollis*, described below]. Collar setae not extending to anterior margin of collar [as originally figured by Levinsen (1883:pl. 2, fig. 2)], in oblique rows sharply bent laterally near posterior end, forming right angle. Eight thoracic setigers.

Remarks.—The only known specimen of the species differs from *N. nudicollis* (Krøyer), described below, primarily in the location and arrangement of radiolar ocelli.

Notaulax rectangulata is also similar to the specimen which Augener (1918) reported as *Hypsicomus torquatus* (not Grube) from West Africa [= *Notaulax* sp.]. The latter is a small specimen on which the slightly incised ventral margin of the collar may be a result of its being immature. The two specimens differ, however, in the orientation of the radiolar ocelli.

The strong curvature on the posterior part of the rows of collar setae of the type-specimen may have been caused by contraction during preservation and may not be important.

Notaulax nudicollis (Krøyer, 1856)
Figs. 25–28

Sabella nudicollis Krøyer, 1856:30, 31.—Levinsen, 1883:188 [footnote; referral to *Notaulax*].
? *Sabella brevicollaris* Grube, 1858:112.

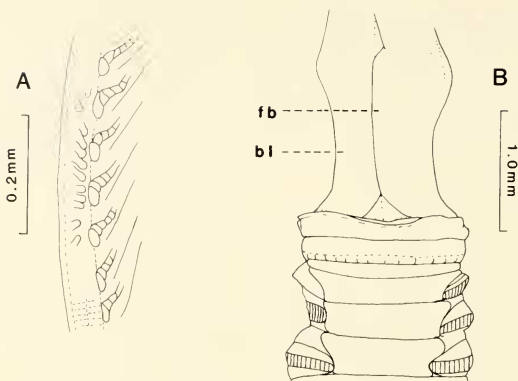


Fig. 24. *Notaulax rectangularata*: A, Region of ocelli of radiole; B, Anterior end of body and part of branchial crown, ventral view.

Sabella torquata Grube, 1877:549, 550 [in part; syntype comprised of loose branchial crown and body with ventrally entire collar].

Protulides elegans Webster, 1884:325, 326, pl. 11, figs. 63–74.—Andrews, 1891:299.—Treadwell, 1901:209; 1939:300 [in part].—Bush, 1905:184.

Hypsicomus torquatus.—Augener, 1918:572–576, text-fig. 101 [in part; report of type specimens of *Sabella torquata*]; 1924:49; 1927:75; 1934:113.—?Fauvel, 1939:23.—Hartman, 1945:47, 48.—Wells and Gray, 1964:74.

Hypsicomus elegans.—Hartman, 1951:115, 116.—Taylor, 1961:244, 245, pl. 9, fig. 3.—?Wills and Bright, 1974:299, fig. 9.—?Rullier and Amoureux, 1979:190, 191.

Hypsicomus phaeotaenia.—Day, 1973:125 [not *Sabella phaeotaenia* Schmarda, 1861].

Material examined.—VIRGIN ISLANDS: St. Thomas, holotype of *S. nudicollis*, collected 18 Sep 1845 (ZMC). Same locality, 2 specimens without branchial lobes (ZMC). NORTH CAROLINA: In coquina rock dredged off Ocracoke Is., 9–12 m, coll., H. W. Wells, 20 Jun 1959, 6+ specimens (USNM 65901). Beaufort, coll., Andrews, 1885 (USNM 4913). Off Beaufort, 10 m, on coral, coll., L. R. McCloskey, 1 specimen (USNM 51233). Bogue Sound, 2.3 m, in empty shells, coll., M. E. Petersen, 6 Aug 1962, 21 specimens (ZMC). Same, E. of Atlantic Beach bridge, 2.5 m, sand, shells, coll., M. E. Petersen and Class, 10 May 1972, 3 specimens (ZMC). Bogue Sound, shallow depth, in large shells, coll., S. L. Gardiner, 28 Jul 1973, 3 specimens (USNM 53972). Same, Oct 1971, 2 specimens (USNM 53971). Onslow Bay, 34°20'N, 76°54'N, 24 m, on coral and rock, coll., E. Powell, 4 Nov 1974, 1 specimen (USNM 53973).—FLORIDA: Off Cape Canaveral, 28°32.5'N, 80°10.3'W, 40 m, R/V *Hernan Cortez*, coll., D. Barber, 2 Apr

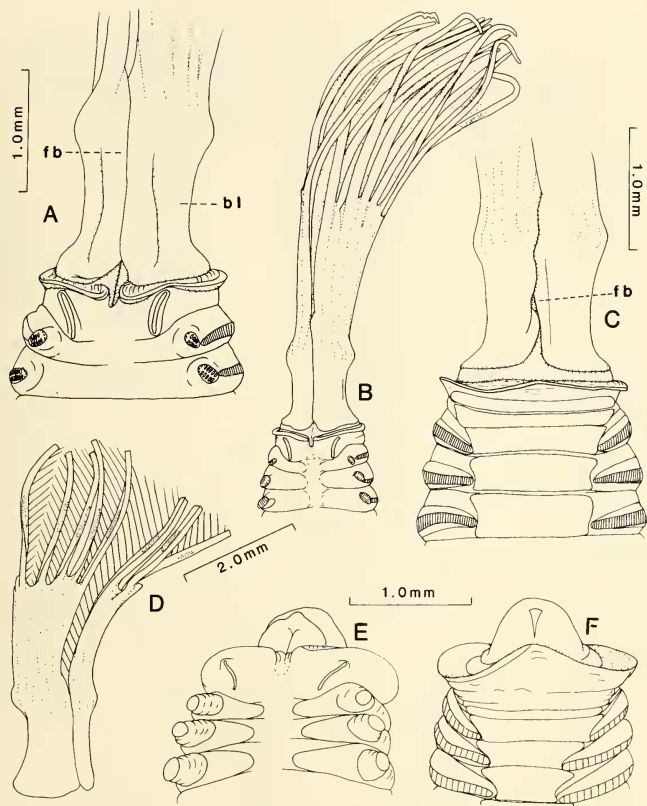


Fig. 25. *Notaulax nudicollis*: A, Anterior part of body and part of branchial crown, holotype of *S. nudicollis*; B, Anterior end, dorsal view of same; C, Anterior part of body and part of branchial crown, ventral view of same; D, Proximal part of detached branchial crown of syntype of *S. torquata*, dorsolateral view; E, Anterior end of body, dorsal view of same; F, Same, ventral view.

1973, 1 specimen (FSBC I 17411). Hutchinson Is., beach seine sta, surf zone, 27°21.4'N, 80°14.5'W, 1 specimen (FSBC I 24016). Same, sta II, 27°21.6'N, 80°13.2'W, 11 m, coarse calcareous sand, on shells, 1 specimen (FSBC I 24010). Same, sta IV, 27°20.7'N, 80°12.8'W, 11 m, coarse calcareous sand, on shells, 7 specimens (USNM 54717; FSBC I 24011–24014). Same, sta V, 27°22.9'N,

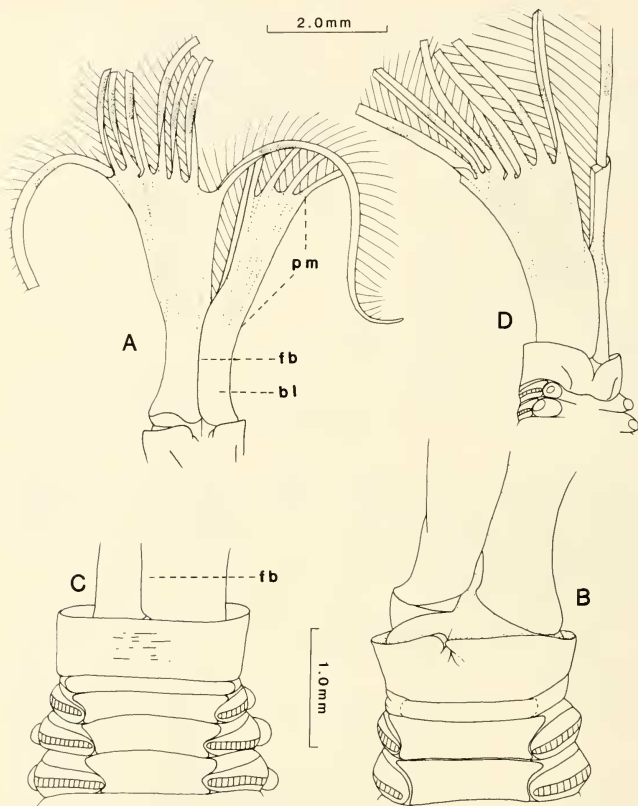


Fig. 26. *Notaulax nudicollis*, anterior ends of thorax and parts of branchial crown: A, Specimen from Brazil identified by Grube as *S. brevicollaris*, dorsal view; B, Same, ventral view; C, Specimen from western Mexico, ventral view; D, Same, dorsolateral view (A, B, ZMB Q 5207; C, D, USNM 41528).

80°13.9'W, 11 m, coarse calcareous sand, on shells, 5 specimens (USNM 54718; FSBC I 24015). Off SE coast, on coral, *Oculina varicosa* Lesueur, 27°10.8'N, 80°00.8'W, 44 m, JSL II 187, coll., L. Edmiston, 19 Apr 1977, 3 specimens (IRCZM 50:856). Same, JSL II 161, coll., F. Stanton, 3 Feb 1977, 1 specimen (IRCZM 50:857). Same, 27°11.4'N, 80°00.9'W, 42 m, JSL II 49, coll., M. Flake,

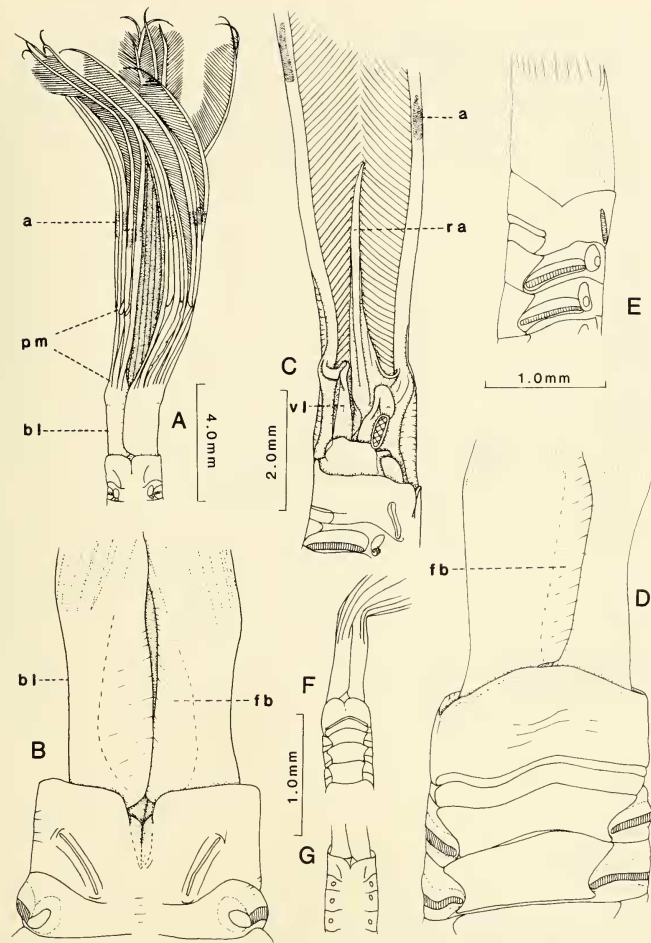


Fig. 27. *Notaulax nudicollis*, Florida specimens: A, Anterior end, dorsal view; B, Anterior end of body and part of branchial crown, dorsal view; C, Same, showing medial view of right half of branchial crown; D, Same, ventral view; E, Same, lateral view of small specimen; F, Same, ventral view of small specimen; G, Same, dorsal view of small specimen (A, FSBC I 24004; B-G, FSBC I 24002; a, region of ocelli).

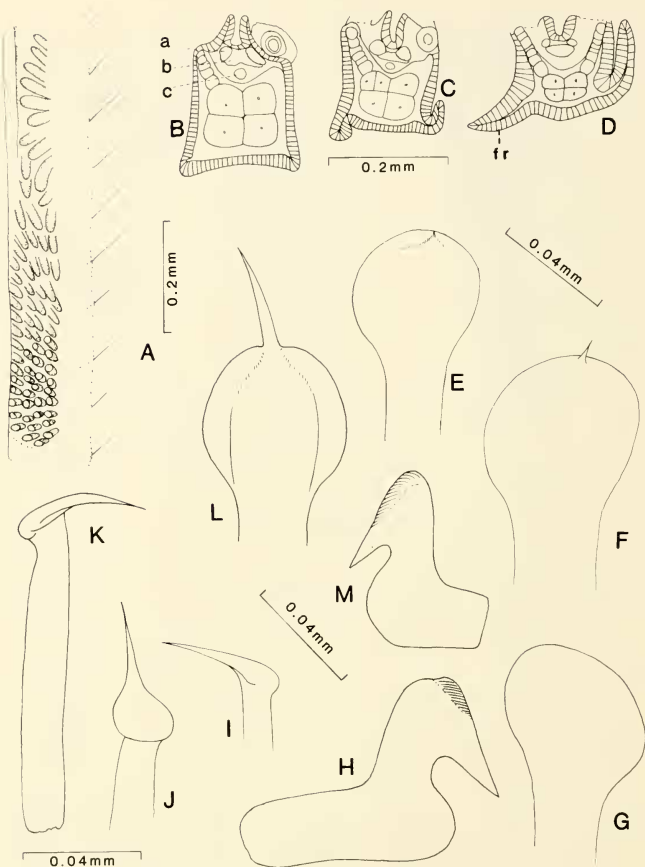


Fig. 28. *Notaulax nudicollis*, Florida specimens: A, Region of ocelli on radiole; B, Cross section of radiole from between palmate membrane and region of ocelli (a, nerve; b, coelomic space; c, blood sinus); C, Same, from distal to ocelli; D, Same, from near tip; E-G, Lower thoracic setae (E, From posterior row; F, Same, with mucro; G, From anterior row); H, Thoracic avicular hook; I-K, Companion setae; L, Abdominal paleate seta; M, Abdominal avicular hook (A-D, FSBC I 24004; E-M, FSBC I 24002).

18 May 1976, 3 specimens (IRCZM 50:798). Same, 27°29.6'N, 80°17.3'W, 5.5 m, SCUBA, coll., L. Edmiston, 28 Jun 1973, 3 specimens (FSBC I 24008). Same, coll., J. Reed, 28 Apr 1977, 1 specimen (IRCZM 50:860). Same, 27°32.8'N, 79°58.8'W, 81 m, JSL I 438, coll., L. Edmiston, 23 Aug 1977, 4 specimens (FSBC I 24009; IRCZM 50:859). Same, 80 m, JSL II 163, coll., F. Stanton, 7 Feb 1977, 2 specimens (IRCZM 50:858). Florida Keys, Monroe County, 1.5 mi N. of Bay Keys, Stock Is., 24°40'02"N, 81°45'20"W, 4 m, coll., W. Jaap *et al.*, 14 Mar 1973, 1 specimen (FSBC I 24005). Safe Harbor, Stock Is., 2.5 m, coll., R. Chesher, 17 Jul 1970, 2+ specimens (USNM 57933). Big Pine Key, 1–2 m, from rock wall of canal, coll., Maynahan, 14 Aug 1973, 1 specimen (USNM 52042). Straits of Florida, 23°36.7'N, 81°06.5'W to 24°36.6'N, 81°05.8'W, 42 m, R/V *Gerda* sta 1033, 26 Feb 1969, 6 specimens (UMML). Gulf of Mexico, Hourglass sta J., 20 nmi off Sanibel Is., 26°24'N, 82°28'W, 18 m, in coral, *Solenastrea*, R/V *Hernan Cortez*, coll., B. Presley, 12 Nov 1965, 18 specimens (FSBC I 24006). Same, 11 May 1966, 11 specimens (BMNH ZB 1980:240–250). Same, Hourglass sta A, 3 nmi off Egmont Key, 27°35'N, 82°50'W, 6 m, sand and shell, R/V *Hernan Cortez*, coll., B. Presley, 2 Jul 1966, 5 specimens (FSBC I 24007). Same, Hourglass sta B, 18 nmi off Egmont Key, 27°37'N, 83°07'W, 18 m, sponge, algae and coral, coll., B. Presley, 11 Sep 1967, 1 specimen (FSBC I 24004). Same, Hourglass sta C, 36 nmi offshore, 27°37'N, 83°28'W, 37 m, in coral, *Solenastrea*, 31 Aug 1966, 31 specimens (FSBC I 24002). Seashore Key, Cedar Keys, Levy County, coll., J. Young, 23 Nov 1957, 1 specimen (USNM 65901). Same, coll., T. Hopkins, Sep 1960, 1 specimen (USNM 65905). Northeastern Gulf of Mexico, Florida Middle Ground, BLM Cr. 01, sta 151, 28°32'02"N, 84°18'36"W, 25–27 m, decalcified from coral, *Madracis decactis* (Lyman), coll., T. Hopkins *et al.*, 5 Oct 1978, 10 specimens (USNM 62084). Proj. EGMEX 70, sta 4, 29°07'N, 85°20'W, 36 m, R/V *Hernan Cortez*, coll., J. Williams *et al.*, 5 May 1970, 1 specimen (FSBC I 24003).—PUERTO RICO: Guanica Bay, USFC str. *Fish Hawk*, 29 Jan 1899, 9 specimens (USNM 16245). Mayaguez Harbor, on corals, USFC str. *Fish Hawk*, 1898–99, 3 specimens (USNM 16217). Ensenada Honda, Culebra Is., USFC str. *Fish Hawk*, 10 Feb 1899, 1 specimen (USNM). Off Vieques Is., USFC str. *Fish Hawk* (157) 6085, 6 Feb 1899, 1 specimen (USNM 16219). Guayanilla Bay, coll., V. Vicente and J. Rivera, 28 Feb 1977, 1 specimen (USNM 54985). Same, 15 Apr 1976, 1 specimen (USNM 54984).—BRAZIL: Santa Catherina Is. (Desterro), coll., Müller, 1 specimen identified as *Sabella brevicollaris* by Grube (ZMB Q 5207).—WESTERN MEXICO: Zihuatanejo, coll., Klawe, 6 Sep 1958, 1 specimen (identified by Berkeley and Berkeley as *Hypsicomus phaeotaenia*; USNM 41528).—WEST AFRICA: *Gazelle* Expedition, 2 syntypes of *Sabella torquata* Grube (2 bodies and 1 branchial crown; ZMB 846) [body with ventrally incised collar = *Notaulax* sp., below].

Description.—Tube horny, translucent, not covered with sediment, mostly embedded in carbonate rocks; tip thick, reddish brown, embedded part thin, golden brown. Body up to 75 mm long, 3 mm wide on specimens fixed in tubes, with thorax up to 6 mm long. Branchial crown to 20 mm long, with 4–5 brown to purple crossbands, 9–14 pairs of radioles; radiolar ocelli in tight, elongate-oval group of 30–70 on each side, diminishing in number distally; groups of ocelli on adults separated from palmate membrane by about length of membrane and thus found in second color band above membrane on Florida specimens (Fig. 27A,

C); separated from palmate membrane by shorter length on type of *Sabella torquata* and on specimens from Brazil and western Mexico (Figs. 25B, D, 26A, D); ocelli in short single row on juvenile specimens; radioles with flanges on outer lateral corners beginning at distal part of region of ocelli and extending to tips (Fig. 28A–D), in cross section view with skeleton of 4 cells; basal lamina up to 0.15 length of branchial crown of adults; dorsal lips (Fig. 27B) extending slightly farther than palmate membrane. Thorax of 8 setigers. Collar of single lobe on adults (Figs. 25A–C, E, F, 26C, D, 27A–D) 2- or 4-lobed on juveniles (Fig. 27E–G), beginning slightly lateral to dorsal midline, joined dorsomedially beneath collar to lamellae which turn anteriorly and join prostomium, extending laterally in almost straight line, usually convex ventrally (rarely ventrally incised from damage, notably on specimens fixed out of tubes) but straight ventrally on specimen from western Mexico (Fig. 26C), incised ventrally, possibly from damage on specimen from Brazil (Fig. 25B). Ventral shield of collar segment (Figs. 25C, F, 26B, C, 27C–F) usually nearly rectangular, sometimes curved, about as broad as anterior margin but only $\frac{1}{2}$ as long as shield of setiger 2, usually with golden brown bar across anterior margin. Ventral shields of other thoracic setigers trapezoidal, with anterior margin broader than posterior, lateral sides concavely curved around tori. Pygidial eyespots present. Collar setae in straight to slightly curved, oblique rows (Figs. 25A, B, E, 26A, D, 27A–C, E, G); thoracic paleae (Fig. 28E–G) slightly asymmetrical in anterior and posterior rows, often with minute mucros. Thoracic avicular hooks up to about 60 in each torus (Fig. 28H), with moderately broad heads; companion setae (Fig. 28J, K) with broad teardrop-shaped blades at right angle to shafts. Abdominal avicular hooks with handles shorter than those of thorax (Fig. 28M); abdominal palaea with short mucros on anterior segments (Fig. 28L), much longer mucros posteriorly, mucros not recessed into tips of setae.

Remarks.—Minor differences among specimens from the Caribbean Sea and adjacent areas and those from West Africa, Brazil, and western Mexico are attributed to geographic separation but are not considered to be sufficient to indicate speciation. Radioles of the larger syntype of *Sabella torquata* have groups of up to 40 ocelli which are separated from the palmate membrane by about half its length. The same is true on the specimen from western Mexico which has groups of up to about 30 ocelli. The smaller syntype of *Sabella torquata*, from which branchial lobes are missing, has a ventrally incised collar and may be conspecific with *Notaulax* sp., below.

The specimen from Brazil, identified by Grube as *Sabella brevicollaris*, has a collar which has widely spaced dorsal origins and is incised ventrally. However, the specimen is somewhat flaccid, and these differences may be caused by improper preservation and thus may not be important. Ocelli of this specimen are similar in position and number to those of the specimen from western Mexico. Grube's (1858) original description of *S. brevicollaris*, based on specimens from St. Croix, Virgin Islands, did not mention radiolar ocelli but otherwise suggests to me that it is the same as *N. nudicollis*.

Notaulax nudicollis is known from West Africa, the western Atlantic region from North Carolina and the Gulf of Mexico to Brazil, and the tropical eastern Pacific region. The species was reported from Bermuda by Bush (1905:184), but I have not examined specimens from there.

Notaulax occidentalis (Baird, 1865), new combination

Figs. 29, 30

Sabella occidentalis Baird, 1865:159, pl. 5, figs. 7, 8.*Protulides elegans*.—Treadwell, 1901:209; 1939:300 [in part; not description; not Webster, 1884].*Sabella alba* Treadwell, 1917:266, 267, pl. 3, figs. 10–15; 1939:294, fig. 108.*Parasabella sulfurea* Treadwell, 1917:267, pl. 3, figs. 16–23; not 1924:18.—Mullin, 1923:51, 52, pl. 7, figs. 7–11.*Hypsicomus purpureus* Treadwell, 1924:20, 21, pl. 2, figs. 30–33.*Hypsicomus circumspiciens*.—?Johansson, 1927:139–141.—Hartman, 1942b:133 [holotype of *Hypsicomus purpureus*] [not Ehlers, 1887].*Hypsicomus torquatus*.—Hartman, 1956:270 [not *Sabella torquata* Grube, 1877].*?Hypsicomus elegans*.—Marsden, 1960:1012, 1013 [in part; not *Protulides elegans* Webster, 1884].*?Hypsicomus phaeotaenia*.—Fauchald, 1977b:62 [damaged specimens; in part; not *Sabella phaeotaenia* Schmarda, 1861].

Material examined.—ST. VINCENT: Syntype of *Sabella occidentalis*, (BMNH ZH 1839:12:27:147).—ANTIGUA: Holotype of *Hypsicomus purpureus*, Pillars of Hercules, Barbados-Antigua Expedition, Univ. Iowa, 1918 (USNM 20325).—FLORIDA: Holotype of *Parasabella sulfurea*, Dry Tortugas, VI-VII-1915 (AMNH 974). Holotype of *Sabella alba*, Dry Tortugas, VI-VII-1914 (AMNH 977). PAN-AMA (ATLANTIC): Galeta Reef, coll., A. Reimer, 5 Oct 1970, 2 specimens (USNM 73020). Same, 1 Nov 1971, 1 specimen (USNM 66400).—BELIZE: Carrie Bow Cay, 12.5 nmi at 140° from Stann Creek Town, barrier reef, 8 m, coll., W. Jaap, 21–24 Oct 1973, 1 specimen (FSBC 1 24017).—PUERTO RICO: Reef at Ponce, USFC str. *Fish Hawk*, 1898–99, 2 specimens (USNM 16218). Caballo Blanco Reef, USFC str. *Fish Hawk*, 1898–99, 4 specimens (USNM 16215). Ensenada Honda. Culebra Is., USFC str. *Fish Hawk*, 10 Feb 1899, 3 specimens (USNM 16216).—BAHAMA ISLANDS: Hydro-Lab, 1.2 nmi at 180° off Bell Channel, Lucaya, near Freeport, Grand Bahama Is., 15 m, in coral, coll., B. A. Vittor and T. S. Hopkins, 28 Jan 1974, 1 specimen (USNM 62083).—?NORTH CAROLINA: Onslow Bay, 34°20'N, 76°54'W, on rock and coral, 24 m, coll., E. Powell, Nov 1974, 1 damaged specimen (USNM 53974).

Description.—Tube dark brown, tough, horny, usually in coral rock (*Sabella alba* and *Parasabella sulfurea* Treadwell, 1917); worms found inhabiting mud tubes in tide pool (*Parasabella sulfurea*.—Mullin, 1923); body usually without color pattern; collar segment occasionally light brown. Branchial crown almost uncolored to highly colored, basal lamina purple to purple brown, region of palmate membrane darker, 4–9 crossbands of purple to brown pigment distal to palmate membrane, pigment extending onto pinules. Body up to 50 mm long; width up to about 5 mm. Branchial crown up to 18 mm long, with 15–17 pairs of radioles; palmate membrane about $\frac{1}{4}$ total length of branchial crown, with basal lamina about $\frac{2}{3}$ length of palmate membrane (Fig. 29A, B). Radioles with 4 skeletal cells in cross section, flanges (Fig. 29D, E) beginning at about middle of free parts, gradually wider distally; tips without pinnules, flattened, long, tongue-shaped; ocelli in single, usually scattered rows of 10–30, beginning just above

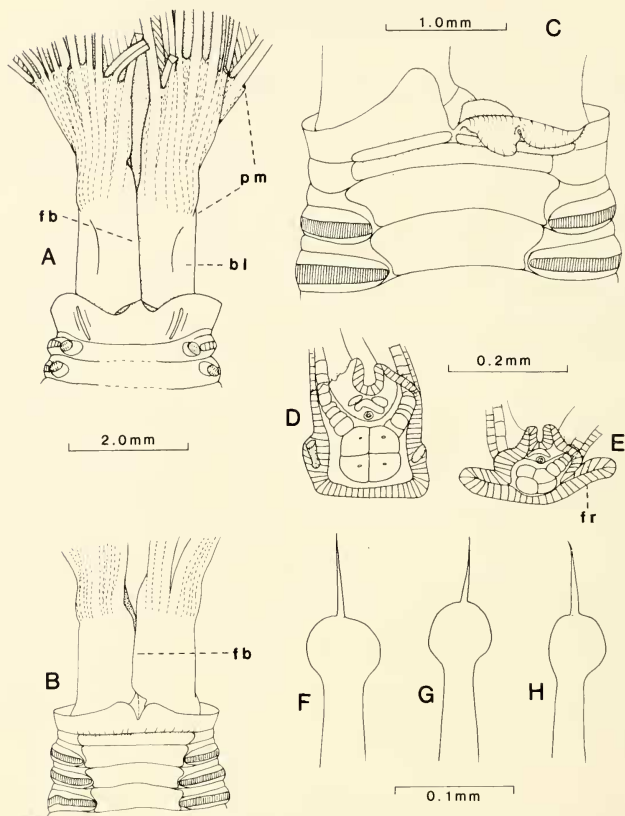


Fig. 29. *Notaulax occidentalis*: A, Anterior end of body and part of branchial crown, dorsal view; B, Same, ventral view; C, Same; D, Cross section of radiole from region of ocelli; E, Same, from near tip; F-H, Abdominal paleate setae from anterior setiger (A, B, F, Syntype of *S. occidentalis*; C-E, G, H, FSBC I 24017).

palmate membrane and extending for up to slightly more than $\frac{1}{2}$ free length (Baird 1865:pl. 5, fig. 8), rows usually longer and eyes more numerous dorsally than ventrally. Dorsal lips and internal organization of branchial crown similar to that of *N. nudicollis* (Fig. 27C). Thorax of 8 setigers; collar bilobed (Fig. 29A-C), beginning dorsally at anterior margin of the collar segment lateral to midline, gradually diverging from margin of collar segment, thereafter flared anteriorly

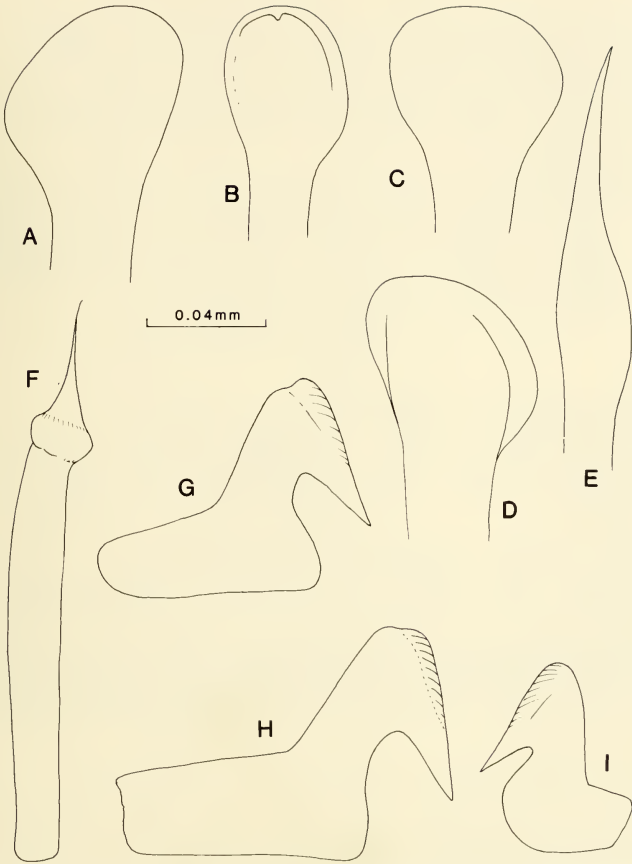


Fig. 30. *Notaulax occidentalis*: A–D, Lower thoracic setae (A, From anterior row; B, From posterior row; C, Same; D, From anterior row); E, Upper thoracic seta; F, Companion seta; G, H, Thoracic avicular hooks; I, Abdominal hook (A, B, E–G, I, FSBC I 24017; C, D, Holotype of *Sabella alba*; H, Holotype of *Parasabella sulfurea*).

around collar setae, slightly concave laterally, incised ventrally, forming 2 short, triangular to rounded lappets. Ventral shield of collar segment rectangular, about as broad as shield of setiger 2 and about $\frac{1}{2}$ as long, often with golden brown bar across anterior margin. Other thoracic ventral shields trapezoidal, with broader

anterior margin and lateral margins curved around tori. Collar setae in straight to slightly curved, slightly oblique rows. Thoracic paleae somewhat asymmetrical in anterior and posterior rows on syntype of *S. occidentalis* from St. Vincent and specimens from Belize and North Carolina, very slightly so on types of *S. alba*, *P. sulfurea*, and *H. purpureus* (Fig. 30A–D). Abdominal paleae with mucros longer than bladed area on anterior segments (Fig. 29F–H), much longer posteriorly. Other thoracic and abdominal setae and uncini as figured (Fig. 30E–I). Pygidial eyespots present.

Remarks.—Specimens reported as *Hypsicomus circumspiciens* [not Ehlers, 1887] by Johansson (1927) from Barthelmy and St. Thomas are questionably the same as *N. occidentalis*. Ocelli of the specimens occupied almost 4/5 of the free length of the radioles, and thus differ from those I have examined. I am not sure that this difference is important. *Notaulax circumspiciens* (Ehlers) has 13 thoracic setigers, thus differing from specimens reported by Johansson.

Notaulax californica (Treadwell, 1906), new combination

Fig. 31

Potamilla californica Treadwell, 1906:1178.

Hypsicomus sp.—Hartman, 1942b:133 [holotype of *P. californica*].

Hypsicomus californicus.—Hartman, 1956:258, 262, 270; 1969:701, 702 [holotype of *P. californica*].

?*Hypsicomus lyra*.—Hartman, 1969:703, 704, figs. 1–6 [not Moore in Moore and Bush, 1904].

Material examined.—CALIFORNIA: Holotype, from vicinity of Monterey Bay, 101–83 m, USFC str. *Albatross* sta 4551, 1904 (USNM 5222).

Description.—Tube absent; body without color pattern, incomplete posteriorly; thorax 2.5 mm long, 1.0 mm wide; branchial crown 7 mm long, with 9 pairs of radioles united by palmate membrane about 1.5 mm above 1.1 mm long basal lamina; radioles with groups of 3–5 lensed ocelli on few ventral radioles, separated from palmate membrane by about membrane length (Fig. 31A); radiolar skeleton of 4 cells in cross section, flanges beginning distal to ocelli and gradually increasing in width distally (Fig. 31B, C). Eight thoracic setigers; collar short, not extending to beginning of branchial crown, bilobed (Fig. 31D, E), beginning on dorsal side lateral to midline slightly back from margin of collar segment, gradually curved around collar setae, concave but entire laterally, incised ventrally. Ventral shield of collar segment rectangular, with brown bar on anterior margin; other thoracic ventral shields trapezoidal, with broader anterior margins, lateral margins concavely curved around tori, about as broad as shield of collar segment and twice as long. Blades of thoracic companion setae broad, with short tips (Fig. 31F–H); thoracic hooks with moderately long, broad handles.

Remarks.—*Notaulax californica* does not appear to be the same as *N. lyra* (Moore, 1904) from Japan, as suggested by Hartman (1969). The latter species has very asymmetrical thoracic paleae; those of the posterior row have mucros as long as the paleate region. *Notaulax lyra* also has thoracic avicular hooks with long tapered handles rather than moderately long, broad ones, and a collar which is apparently similar on the dorsal side to that of *N. nudicollis*. Specimens reported by Hartman (1969) from California as *Hypsicomus lyra* may be neither that species

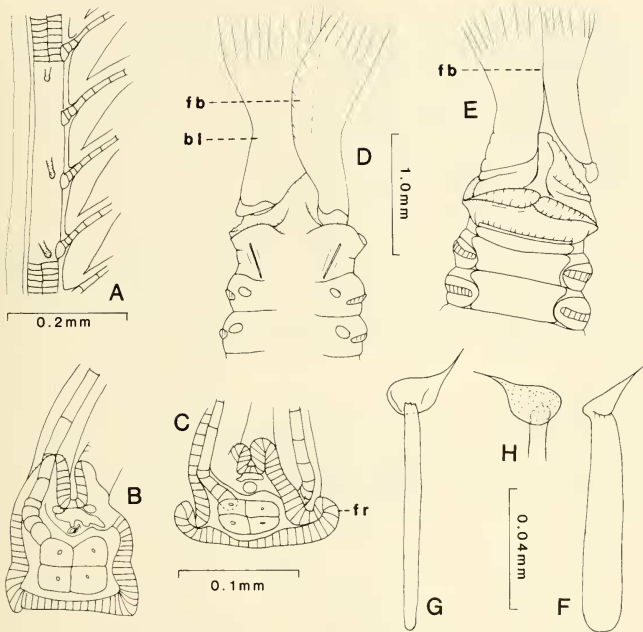


Fig. 31. *Notaulax californica*: A, Region of ocelli on ventral radiole, lateral view showing ocelli and internal structure; B, Cross section of radiole distal from palmate membrane; C, Same, from near tip; D, Anterior part of body and part of branchial crown, dorsal view; E, Same, ventral view; F-H, Companion setae, various views.

nor *N. californica*; Hartman did not illustrate nor note the unique thoracic paleae of *N. lyra*.

One of Hartman's figures of setae of *H. lyra* (1969:703, fig. 6) was redrawn from Moore and Bush (1904:pl. 11, fig. 6) and is a companion seta of *Potamilla acuminata* Moore, 1904.

Notaulax midoculi (Hoagland, 1919), new combination
Fig. 32

Parasabella midoculi Hoagland, 1919:579, pl. 31, figs. 10-14, pl. 32, figs. 1, 2.
Parasabella sulfurea.—Treadwell, 1924:18 [not Treadwell, 1917].
Hypsicomus midoculi.—Johansson, 1927:141.

Material examined.—FLORIDA: Loggerhead Key [probably Dry Tortugas],

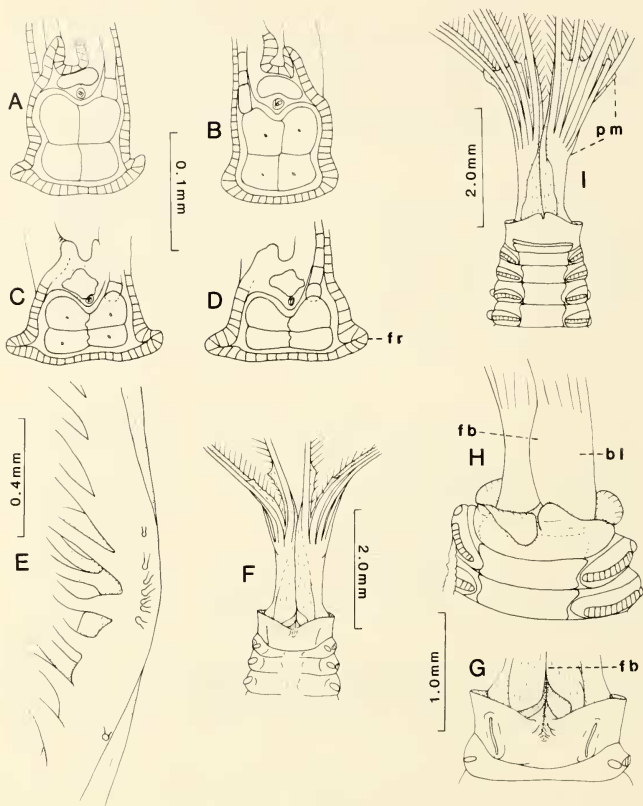


Fig. 32. *Notaulax midoculi*: A–D, cross sections of radiole (A, From immediately distal to end of palmate membrane; B, From immediately distal to region of ocelli; C, D, From between region of ocelli and tip); E, Region of ocelli of radiole; F–I, Anterior end of body and part of branchial crown (F, G, Dorsal view; H, I, Ventral view) (A–E, H, Holotype; F, G, I, USNM 20304).

coll., Treadwell, 1919, holotype (AMNH 1186).—BARBADOS: Bathsheba, Barbados-Antigua Expedition, Univ. Iowa, 1918, 1 specimen (USNM 20304).

Description.—Tube unknown; color pattern absent except for small band near midregion of branchial crown. Body of holotype 40 mm long, 1.5 mm wide across thorax. Branchial crown 5 mm long on holotype, 9 mm long on other specimen; 9–10 pairs of radioles united above basal lamina by palmate membrane for 1/6 of

their length; length of basal lamina similar to that of palmate membrane; radiolar skeleton of 4 cells in cross section; radioles only slightly flanged near tips (Fig. 32A–D), with about 6 lensed ocelli on each side in pigment band at midregion of branchial crown (Fig. 32E; also Hoagland, 1919:pl. 31, fig. 11). Eight thoracic setigers. Collar with margins extending past beginning of branchial crown (basal lamina) dorsolaterally and ventrally, bilobed, beginning dorsally lateral to midline and back from margin of collar segment on holotype (Hoagland, 1919:pl. 31, fig. 10), near anterior margin of collar segment on specimen from Barbados (Fig. 32F, G), slightly concave laterally on holotype, straight on specimen from Barbados, ending ventrally in moderately long, rounded lappets on holotype (Fig. 32H) and in shorter lappets on specimen from Barbados (Fig. 32I). Ventral shield of collar segment with very indistinct lateral and anterior margins on holotype (Fig. 32H), similar to those of other species on specimen from Barbados (Fig. 32I). Ventral shields of other thoracic setigers trapezoidal, anterior margins broader, lateral margins concavely curved around ventral margins of tori. Pygidial eyespots present. Setae and uncini similar to those of *N. nudicollis*; no minute mucros visible on thoracic paleae.

Remarks.—On the holotype of *Parasabella midoculi*, both the length and width of branchial lobes appear to be small compared with body size, and the ventral shield of the collar segment is indistinct. This indicates to me that the anterior end of the holotype had recently regenerated and that the collar and branchial lobes of the specimen from Barbados may be more typical of the species. The latter specimen is broken but complete, and the abdomen is full of eggs, indicating that it is mature.

Notaulax paucoculata, new species

Figs. 33, 34

Material examined.—BAHAMA ISLANDS: Hydro-Lab, 1.2 nmi at 180° off Bell Channel, Lucaya, near Freeport, Grand Bahama Is., 26°33'N, 78°34'W, 41 m, coll., Sylvia Earle and Ann Hurley, 8 Jul 1974, holotype (USNM 62077). Same, 9 Jul 1974, paratype (USNM 62079). Same, 12–30 m, coll., Morgan Wells *et al.*, 3–15 Apr 1974, paratype (USNM 62078).

Description.—No tubes present. Branchial lobes cross-banded with purple-brown pigment, with broad, proximal band on lower half of palmate membrane region, with broad middle band just distal to palmate membrane and narrow, distal band at distal $\frac{2}{3}$ of free region of radioles (Fig. 33A); body uncolored except for light brown ventral shields beginning at about middle of thorax and extending onto abdomen. Body of complete paratype 25 mm long, thorax 3.3 mm long and 1.8 mm wide; branchial crown about 10 mm long on complete paratype, 11 mm long on holotype. Radioles 10–12 pairs, united proximally above basal sheet for $\frac{2}{5}$ of their length (Fig. 33A–C), broadly flanged above palmate membrane for entire length; radiolar skeleton in cross section of 4 cells (Fig. 33D, E); ocelli in small group of 4–5 (Fig. 33A, F) on lateral borders below flanges at distal end of middle color band, separated from palmate membrane by about $\frac{1}{3}$ its length; basal lamina slightly less than half length of palmate membrane. Eight thoracic setigers; collar long, exceeding origin of branchial crown (Fig. 33A–C), deeply incised dorso-medially back to anterior ends of rows of collar setae but with dorsal margin completely separated from collar segment or prostomium even at deep incision,

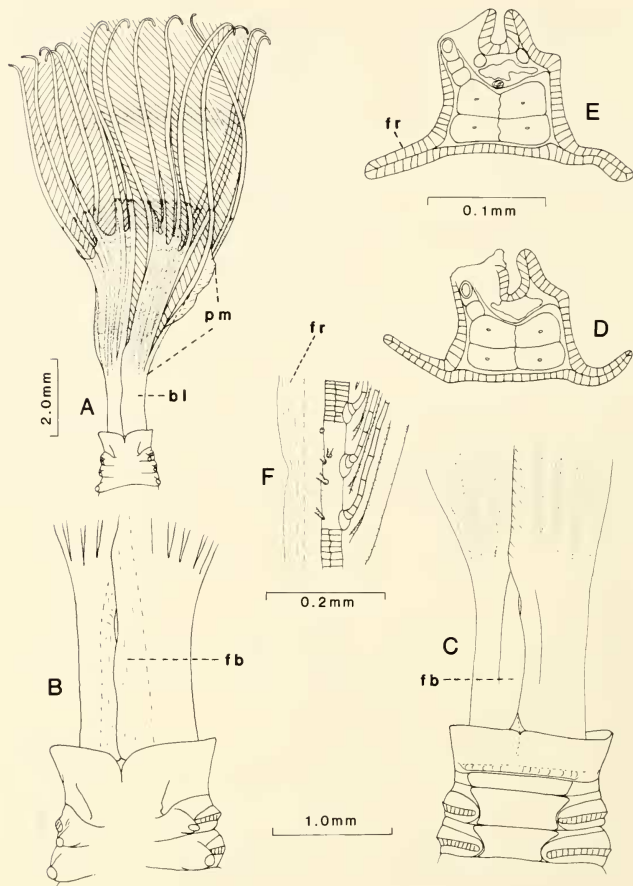


Fig. 33. *Notaulax paucoculata*: A, Anterior end, dorsal view; B, Anterior end of body and part of branchial crown, dorsal view; C, Same, ventral view; D, Cross section of radiole from between palmate membrane and ocelli; E, Same, immediately distal to ocelli; F, Region of ocelli of radiole (A–C, F, Holotype; D, E, Paratype, USNM 62078).

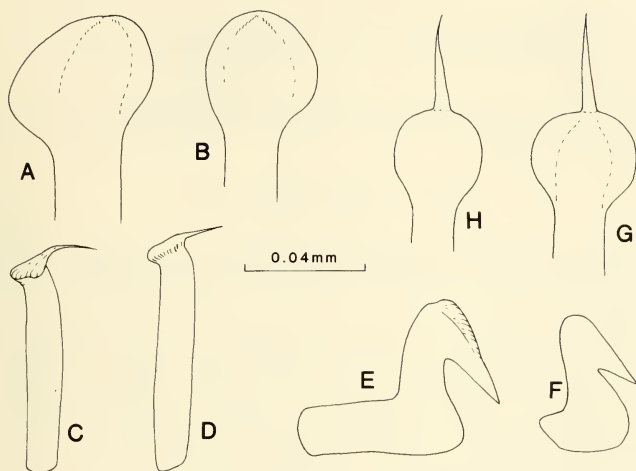


Fig. 34. *Notaulax paucoculata*, paratype (USNM 62078): A, Lower thoracic seta from anterior row; B, Same, from posterior row; C, D, Companion setae; E, Thoracic avicular hook; F, Abdominal avicular hook; G, H, Abdominal paleate setae, first abdominal setiger.

laterally extending in almost straight line to midventrum, with slight midventral incision; ventral shield of collar segment trapezoidal to rectangular, slightly wider than on following segment but less than half as long, with brown bar across anterior margin; other thoracic ventral shields trapezoidal, anterior margins broader, lateral margins curved around tori. Pygidium with eyespots. Collar setae in oblique, curved rows extending from posterior margin of segment about $\frac{1}{2}$ distance to anterior margin of collar. Notoetae of remaining segments including upper arc of short, stout, hooded setae above 2 rows of paleae (Fig. 34A, B); paleae slightly broader in anterior row; no minute mucros observed; thoracic tori with numerous avicular hooks with moderately long handles and crest of minute teeth, and similar number of companion setae (Fig. 34C–E). Abdominal avicular hooks (Fig. 34F) similar to those of thorax but with shorter handles; setae including 2–3 paleae (Fig. 34G, H), those on anterior segments with mucros slightly longer than paleate area, longer posteriorly, mucros not recessed into tips, and similar numbers of long, slender capillaries.

Remarks.—*Notaulax paucoculata* differs from other species of the genus in the following suite of characters: 1) radioles have few ocelli; 2) the dorsal margin of the collar is deeply incised but not joined at the posterior end of the incision with the peristomium-collar segment; and 3) flanges occur on the complete free length of the radioles. The dorsal region of the collar of *N. paucoculata* superficially resembles that of *N. nudicollis*; however, on the latter species, the collar is joined

at the posterior part of the incision with the peristomium-collar segment. Ocelli *N. paucoculata* are similar to those of *N. midoculi*, but radioles and the dorsal region of the collar of the latter species are completely different from those of *N. paucoculata*.

Etymology.—The specific name is derived from the Latin *paucus*, meaning few, and *oculatus*, meaning having eyes, and refers to the small number of ocelli on lateral sides of radioles.

Notaulax bahamensis, new species

Figs. 35, 36

Material examined.—BAHAMA ISLANDS: Hydro-Lab, 1.2 nmi at 180° off Bell Channel, Lucaya, near Freeport, Grand Bahama Is., 26°33'N, 78°34'W, 15 m, on coral, coll., B. A. Vittor and T. S. Hopkins, 28 Jan 1974, holotype (USNM 62082).

Description.—Body without color pattern; branchial lobes with 4 color bands, 2 in region of palmate membrane, 1 immediately distal to palmate membrane, and 1 at about mid-length of free parts of radioles; radioles (Fig. 35A) 12 pairs, united proximally by palmate membrane for about 40% of their length above basal lamina, flanged from palmate membrane to tips except for small part of region of ocelli (Fig. 35B–D); basal lamina half as long as palmate membrane; ocelli numbering up to about 30, in oval groups similar in organization to those of *N. nudicollis* but separated from palmate membrane by only $\frac{1}{3}$ of its length. Thorax of 8 setigers; collar of single lobe, margin beginning near dorsal midline well back from anterior margin of collar segment, extending straight anteriorly, abruptly curved, almost straight laterally, with ventral margin convex; collar segment (Fig. 35E, F) much longer than next two setigers, with collar setae on posterior $\frac{1}{3}$, with ventral shield subtriangular. Pygidial eyespots present. Thoracic paleae (Fig. 36A, B) strongly asymmetrical in anterior and posterior rows; thoracic avicular hooks (Fig. 36C) with moderately slender necks and broad handles; thoracic companion setae with blades of moderate length (Fig. 36D, E); abdominal paleae (Fig. 36F, G) with base of mucros recessed into tip of setae; abdominal avicular hooks similar to those of thorax but with shorter handles.

Remarks.—*Notaulax bahamensis* appears to be unique in the following characters: 1) the collar segment is longer than the following two segments, has a triangular ventral shield, and has setae only on the posterior $\frac{1}{3}$; and 2) bases of mucros on abdominal paleae are recessed into spoon-shaped parts. The species appears to be closely related to *N. nudicollis*, but differs from the latter in having lateral flanges on almost the complete free length of the radioles, and in having thoracic paleae which are strongly asymmetrical in anterior and posterior rows.

Notaulax sp.

Fig. 37

?*Sabella torquata* Grube, 1877:549, 550 [in part].

Hypsicomus pigmentatus.—Fauvel, 1914b:146–148, pl. 8, figs. 252–254 [not Gravier, 1906a].

Hypsicomus torquatus.—Augener, 1918:572–576, text-fig. 101 [in part].

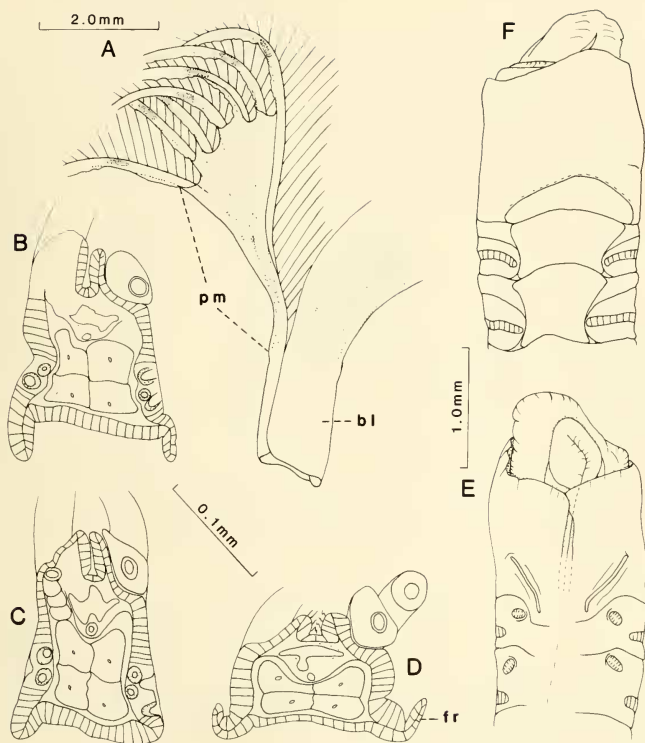


Fig. 35. *Notaulax bahamensis*, holotype: A, Proximal part of detached branchial crown, dorso-lateral view; B, Cross section of radiole from middle of region of ocelli; C, Same, from distal part of region of ocelli; D, Same, from about half distance from ocelli to tip; E, Anterior end of body, dorsal view; F, Same, ventral view.

Material examined.—WEST AFRICA: ?*Gazelle* Expedition; syntype of *Sabella torquata* Grube with ventrally incised collar (ZMB 846); specimen misidentified as *Hypsicomus torquatus* (Grube) by Augener, 1918 (ZMH V 8721).

Description.—Body about 22 mm long, branchial crown 9 mm long; thorax 2.5 mm long, 1.7 mm wide, gradually increasing in diameter from collar segment; anterior abdomen slightly wider; 12 pairs of radioles united for about 1/5 of their lengths by palmate membrane, latter about twice longer than basal lamina; radioles flanged distally, each with group of ocelli in single row of 8–15 on each side (Fig.

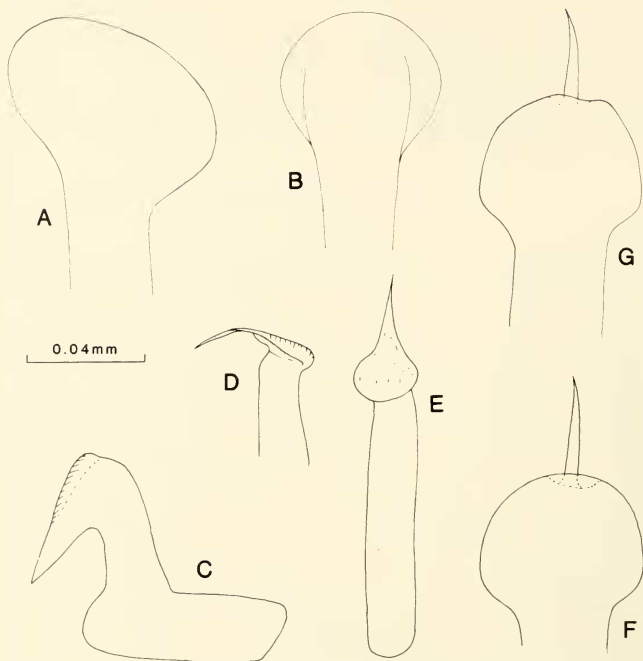


Fig. 36. *Notaulax bahamensis*, holotype: A, Lower thoracic seta, anterior row, setiger 4; B, Same, posterior row; C, Thoracic avicular hook; D, E, Companion setae; F, G, Abdominal paleate seta, second abdominal setiger, opposite views.

37A), separated from palmate membrane by about its length or near midlength of branchial crown; ocelli oriented laterodistally on near end, gradually changing to mediodistal orientation at distal end, covering angle of less than 90° . Thorax with 8 setigers; collar bilobed, similar to that of *N. nudicollis* dorsally, almost straight laterally, slightly incised ventrally (Fig. 37B, C). Ventral shield of collar segment rectangular; other thoracic ventral shields trapezoidal, slightly broader anteriorly, concave laterally. Setae as figured by Augener (1918:574), similar to those of *N. nudicollis*.

Remarks.—The specimen of Augener (1918) may be conspecific with the smaller syntype of *Sabella torquata* Grube, which has a ventrally incised collar. The syntype is missing the branchial crown and, therefore, is probably indeterminable. Augener's specimen is not conspecific with the other syntype of *S. torquata* (Fig. 25D–F), which is a specimen of the west African form of *Notaulax nudicollis*. See also *Remarks* for *N. nudicollis*.

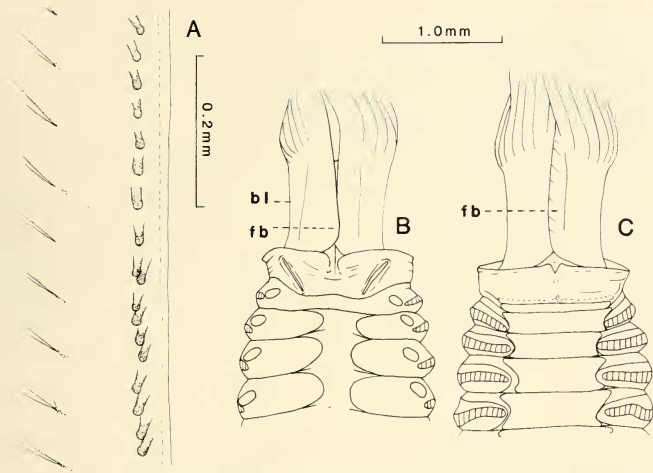


Fig. 37. *Notaulax* sp. (ZMH V-8721): A. Region of ocelli on radiole, lateral view, distal end up; B, Anterior end of body and part of branchial crown, dorsal view; C, Same, ventral view.

Megalomma Johansson, 1927

Branchiomma.—Claparède, 1869:162, 163 [not Kölliker, 1858].

Megalomma Johansson, 1927:130.

Type-species.—*Amphitrite vesiculosa* Montagu, 1815; subsequent designation by Hartman (1959:549).

Diagnosis.—Radioles in semicircular arrangement, without lateral flanges, stylodes or palmate membrane, one or more pairs with composite, subterminal eyes positioned mainly on inner surface, all with broad bands of cilia on outer lateral corners (Fig. 43B); branchial crown without flanges proximally on upper and lower margins of fused base; dorsal lips (palps) with radiolar appendage functioning as midrib with broad lamellae above and below (Figs. 38B, 39B, 43A), with pinnular appendages on upper margin where upper lamellae join first dorsal radioles; ventral lips paired; ventral sacs often present. Collar variable. Collar setae similar to upper thoracic setae, slender, narrowly hooded, in short oval group or 2 rows; upper thoracic setae in arc above notopodial lobe; lower thoracic setae long to short, thus narrowly to broadly hooded, arranged in transverse group or 2 transverse rows; thoracic avicular hooks with moderately long to long handles (Figs. 38H, I, 43H, I); companion setae with moderately thick, spear-shaped or teardrop-shaped (pennonate) blades at right angles to shafts. Abdominal setae of single type, hooded, in 2 transverse rows, sometimes forming elongate-oval group with long axis transverse, both rows bent together forming sharp, blade-like edge; abdominal avicular hooks similar to those of thorax but with shorter handles.

Remarks.—Lower thoracic setae on the type-species are long and slender, with hooded area, including tip, about 10 times longer than broad and only faintly hooded (Fauvel 1927:316, fig. 109h, i), whereas on most other species they are shorter and broadly hooded as on most *Demonax* species (Figs. 41D–F, 43E–G). In fact, on some species they are nearly spatulate.

The collar of some species begins near the dorsal midline on or near the anterior margin of the collar segment, whereas in a few species it begins immediately above the collar setae. In still others, the dorsal origin of the collar may begin somewhere between the above locations, and the dorsal part of the collar may vary during development, with the dorsal origin gradually moving anteriorly and medially as a specimen grows. When the origin of the collar approaches the midline, it may be deeply incised dorsolaterally, or may form deep dorsolateral pockets; similar variation in the shape of the collar occurs on species of *Pseudopotamilla* Bush. Lateral margins of the collar are entire. A key to species is not presented because there are many species of *Megalomma* from Florida waters remaining to be reported or described.

Megalomma bioculatum (Ehlers, 1887)

Fig. 38

Branchiomma bioculatum Ehlers, 1887:260–263, pl. 53, figs. 1–9.—Hartman, 1938:18 [examination of type-specimens; considered as *Megalomma*].

Not *Branchiomma bioculatum*.—Augener, 1918:370–372 [= *Megalomma* sp.].

Megalomma bioculatum.—Johansson, 1927:132.—Hartman, 1965b:234.

Not *Megalomma bioculatum*.—Nonato and Luna, 1970:98, 99, fig. 101 [= *Megalomma* sp.].

Material examined.—STRAITS OF FLORIDA: Hab. 1, W. of Tortugas, 24°37'03"N, 83°36'00"W, 110 fms. (201 m), USCS str. *Blake*, sta 25AG, Dec 1877–Mar 1878; Hab. 2, off Bahia Honda, 24°29'39"N, 81°17'30"W, 91 fms. (166 m), USCS str. *Bibb*, sta 16P, 4 May 1868, 5th dredging, several syntypes (MCZ) [type-locality data from Smith (1889, pp. 963 and 958, respectively); specimens have been dried; in very poor condition; lots possibly mixed]. Off Grassy Key, 24°37.7'N, 80°58.6'W to 24°36.1'N, 80°57.4'W, 139–185 m, 10' otter trawl, R/V *Gerda*, sta 1035, 26 Feb 1969, 8 specimens (USNM 67956; MCZ; BMNH ZB 1981.23; UMML; FSBC 1 27694). Off Big Pine Key, 24°28.4'N, 81°24.3'W to 24°30'N, 81°17.6'W, 135–146 m, 10' otter trawl, R/V *Gerda*, sta 1028, 25 Feb 1969 (UMML).—MID-ATLANTIC STATES: 39°16.5'N, 72°29.6'W, 136 m, R/V *Pierce*, BLM 04B, sta A3, 22 Aug 1976, 1 small specimen (12 mm total length; USNM 57497).—NEW ENGLAND: 40°31'N, 67°19'W, 143 m, fine sand, R/V *Albatross III*, Cr. 69, coll. 10, 19 Nov 1955, 10 specimens (USNM 57370).—?PUERTO RICO: Palmas Atlas, 90 m, coll., N. Hulings and D. Feray, 1963, 1 very small specimen (5 mm total length; USNM 42792).

Description.—Tube friable, covered with foraminiferan tests on Florida specimens, slightly more rigid and covered with siliceous sand grains on New England specimens (USNM 57370). Body up to 47 mm long, with about 100 segments; branchial crown up to 26 mm long with broad reddish-brown crossband on middle third, with moderately long fused region proximally, and about 15 pairs of radioles; dorsalmost pair of radioles with large subterminal eyes, very short tips distal to

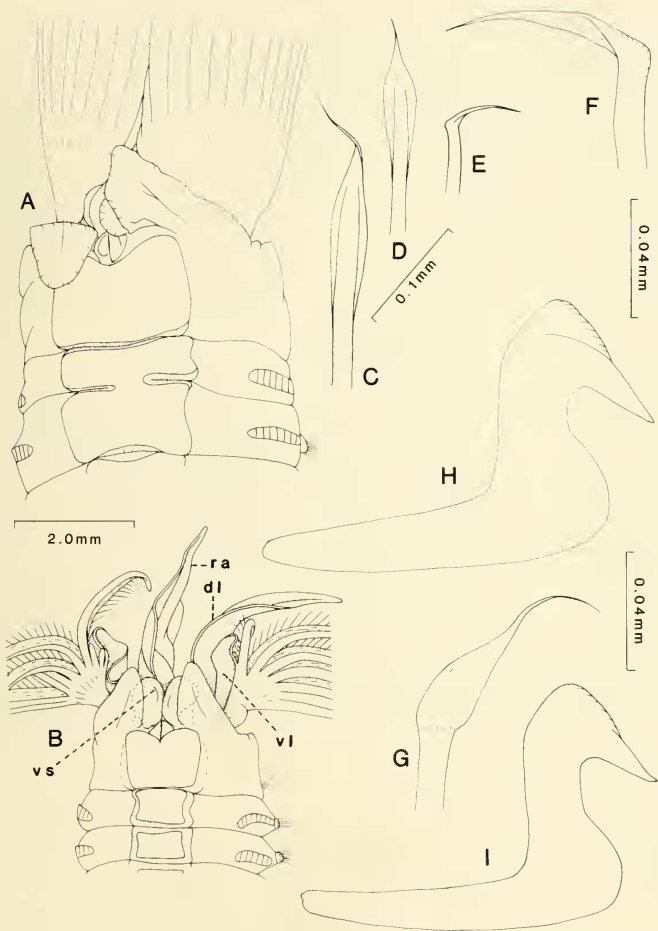


Fig. 38. *Megalomma bioculatum*: A, Anterior end of thorax and part of branchial crown, ventral view, specimen from Straits of Florida; B, Same, specimen from off New England, showing dorsal and ventral lips and ventral sacs; C, D, Lower thoracic setae; E-G, Companion setae; H, Thoracic avicular hook, setiger 3; I, Same, from setiger 7 (A, FSBC I 27694; B, USNM 57370; C-I, Syntypes).

eyes. Dorsal lips moderately long, with short pinnular appendage on margin of upper lamella; ventral sacs well developed; ventral lips moderately high (Fig. 38B). Thorax with 8 setigers; collar bilobed, beginning dorsally near posterior margin of segment just above collar setae and exposing most of collar segment dorsally, extending anteriorly then curving ventrally, straight laterally, ending ventrally in moderately long, triangular lappets; lappets extending to about beginning of radioles midventrally; pair of small, triangular lobes ventromedially between anterior margin of ventral shield and beginnings of ventral sacs. Collar ventral shield plain, longer and broader than others, with anterior margin incised or concave (Fig. 38A, B); other thoracic ventral shields slightly concave laterally. Lower thoracic setae slender, with moderately long blades (Fig. 38C, D); thoracic avicular hooks and companion setae (Fig. 38E–G) in moderately long tori well separated from ventral shields; avicular hooks with long handles (Fig. 38H, I). Abdominal tori shorter than those of thorax; avicular hooks with handles shorter than those of thorax; setae in 2 transverse rows.

Remarks.—Ehlers' figure (1887:pl. 53, fig. 9) of a thoracic avicular hook is incorrect; handles on those of type-specimens that I examined are much shorter than illustrated originally (Fig. 38H, I).

Megalomma bioculatum appears to be a lower shelf-upper slope species. All shallow water specimens identified as *M. bioculatum* that I have examined have proved to be *M. pigmentum* Reish or other species. I suspect that all of the numerous specimens reported as *M. bioculatum* from shallow waters of the Caribbean area belong to other species as well [see Perkins and Savage (1975) and also account of *M. pigmentum*, below]. *Megalomma pigmentum* Reish, which also has only one pair of eyes, has bilobed ventral lappets of the collar, and the ventral shield of the collar segment is divided into two parts by a transverse groove. Further, the small eyes of *M. heterops* n. sp., described below, may be easily overlooked, especially on small specimens, and specimens of that species may be misidentified as *M. bioculatum*.

The reports of *Branchiomma bioculatum* [= *Megalomma*] from shallow water of tropical West Africa by Augener (1918) and *M. bioculatum* from Brazil by Nonato and Luna (1970) are incorrect. The collar described by Augener for his specimens resembles that of *M. heterops* n. sp., as does the collar on specimens reported by Nonato and Luna (1970). However, both West African and Brazilian specimens apparently have only one pair of eyes and are here considered to be undetermined species of *Megalomma*.

The species is known from the Straits of Florida, the Atlantic Ocean off New Jersey and New England, and possibly from Puerto Rico in depths of 90 to about 200 m.

Megalomma lobiferum (Ehlers, 1887)

Figs. 39, 40

Branchiomma lobiferum Ehlers, 1887:254–259, pl. 53, figs. 10–15.—Augener, 1924:52 [list].—Hoagland, 1919:577.—Treadwell, 1924:18; 1939:291, 292, fig. 105.—Hartman, 1938:18 [examination of type-specimen; as *Megalomma*].—Fauvel, 1953:17.—Bellan, 1963:313.

Megalomma lobiferum.—Johansson, 1927:132.—Hartman, 1951:115.—Dauer, 1973:193.

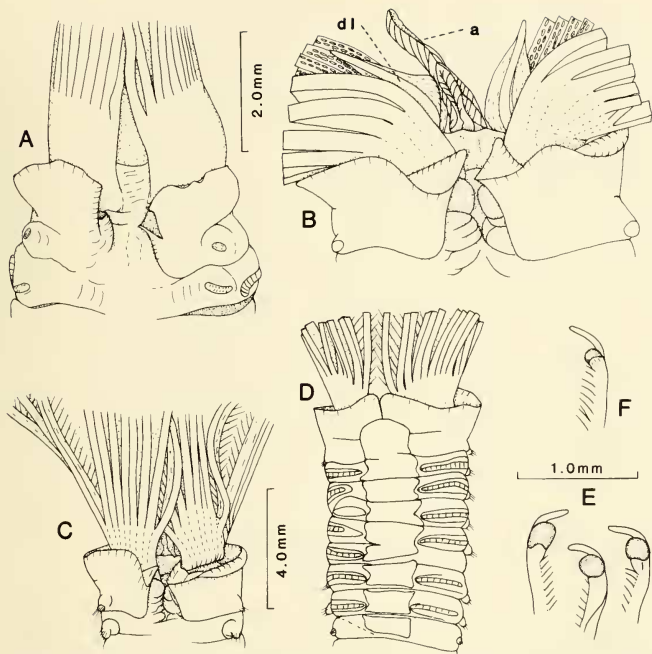


Fig. 39. *Megalomma lobiferum*: A–C, Anterior ends of body and parts of branchial crown, dorsal views (a, caruncle); D, Same, ventral view; E, Eye of first dorsal radiole, various views; F, Eye on another dorsal radiole. (A, E, F, Holotype; B–D, Specimen from Stock Is., near type-locality, MCZ).

Megalomma vesiculosum.—Fauchald, 1977b:62 [in part; not *Amphitrite vesiculosa* Montagu].

Material examined.—FLORIDA: Key West, 2–4 m, holotype (MCZ). Stock Is., near Key West, about 0.5 km SE of entrance to Safe Harbor, 24°33.3'N, 81°43.8'W, 1.5 m, with *Thalassia*, coll., J. Thomas, 29 Jul 1977, 1 specimen (MCZ). Hutchinson Is., sta V, 27°22.9'N, 80°13.9'W, 11 m, coarse calcareous sand, coll., Gallagher *et al.*, 10 Jun 1976, 1 specimen (FSBC I 27695). Off Pepper State Park, St. Lucie County, 27°29.6'N, 80°17.3'W, 5.2 m, on coral, *Oculina varicosa* Lesueur, coll., J. K. Reed and L. Edmiston, SCUBA, 28 Apr 1977, 1 specimen (IRCZM 50:836). St. Petersburg Beach, on sponge washed ashore, coll., C. H. Saloman, 29 Jan 1966, 1 specimen (USNM 67975).—PUERTO RICO: Bahia de San Juan, dredged, coll., E. Ortiz-Corpi, 31 May 1974, 1 specimen (USNM 52061).—PANAMA (ATLANTIC): Galeta Reef, coll., Reimer, 6 specimens (USNM 73019).

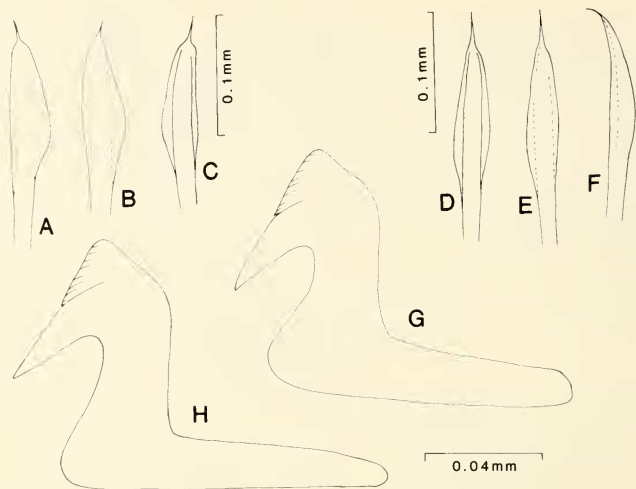


Fig. 40. *Megalomma lobiferum*: A-F, Lower thoracic setae (A, Lower, anterior row; B, Same; C, Middle, posterior row; D, Lower, posterior row; E, Same; F, Same, turned); G, H, Thoracic avicular hooks (A-F, Holotype; G, H, Specimen from Stock Is., near type-locality, (MCZ).

Description.—Tube moderately thick, rigid, almost smooth, covered with thin layer of mud or detritus, with small pieces of sand and shell cemented in yellow, translucent matrix on one specimen (IRCZM 50:836). Body up to 43 mm long, 5.5 mm wide; 8 thoracic and up to 90 abdominal segments. Branchial crown maximally 16 mm long, 18–21 pairs of radioles on larger specimens, 8 left and 9 right radioles on small specimen from Hutchinson Island, crossbanded with yellow-orange pigment extending onto pinnules on IRCZM specimen. Composite eyes on all radioles, moderately large on dorsalmost pair, abruptly smaller, about half as large on second dorsal pair (Fig. 39E, F), very gradually decreasing laterally and ventrally, those on ventralmost pair about equal in diameter to width of tips of radioles; all eyes similar, well defined, spherical, with distinct ommatidia. Branchial crown with moderately long fused region (Fig. 39A–D); dorsal lips moderately long, with margin of upper lamella fused proximally with base of short pinnule of dorsalmost radiole; ventral lips short, rounded; ventral sacs absent on continuation of ventral lips between branchial lobes and collar. Caruncle on anterior margin of shelf region between dorsal lips of branchial lobes and above mouth (Fig. 39B a). Collar bilobed (Fig. 39A–D), with margin beginning dorsally on anterior margin of collar segment about half distance from midline to lateral side, turned medially to near midline, then slightly posteriorly and laterally, forming deep pockets extending to posterior margin of segment, straight on lateral sides, ending ventrally in short, rounded lappets; ventral shield of collar segment

(Fig. 39D) up to twice broader than long, convex laterally, straight to convex anteriorly; other ventral shields of thorax usually concavely rounded laterally around tori. Collar setae moderately long, narrowly hooded; other thoracic segments with arc of slender, narrowly hooded setae above 2 rows of short, lower thoracic setae with hooded regions plus mucronate tips 4–6 times longer than broad (Fig. 40A–F); thoracic avicular hooks with handles $\frac{1}{3}$ longer than height (Fig. 40G, H), and companion setae in long tori extending from notopodial lobes to ventral shields.

Remarks.—This species appears to be unique in having a caruncle on the base of the branchial crown between the dorsal lips. This lobe is somewhat longer on the specimen figured than on the type or other specimens examined. Lower thoracic setae, which were not figured by Ehlers, are moderately long, and thoracic avicular hooks have long handles. The latter, with accompanying companion setae, are in long rows extending to ventral shields, whereas on other species of *Megalomma* I have examined, tori are much shorter.

Descriptive information given by most authors in accounts of this species (Hoagland 1919; Augener 1924; Treadwell 1924, 1939; Hartman 1951; Fauvel 1953; Dauer 1973) is insufficient for me to confirm that they actually had *M. lobiferum*; however, considering the account of Bellan (1963) and the specimens reported herein, it is not unreasonable to assume that the species is widely distributed in shallow waters of the Caribbean area. In Florida, the species occurs in shallow water in the Florida Keys and on both the southern Atlantic and Gulf of Mexico coasts.

Megalomma pigmentum Reish, 1963

Fig. 41

Megalomma pigmentum Reish, 1963:430–433, fig. 16.—Hartman, 1969:709, 710, figs. 1–7.

Megalomma bioculatum.—Taylor, 1971:714–716.—Day, 1973:126.—Hall and Saloman, 1975:19 [not *Branchiomma bioculatum* Ehlers, 1887].

Material examined.—WESTERN MEXICO: Bahia de San Quintin, Baja California, sta 43, silty sand, 8 paratypes (USNM).—NORTH CAROLINA: off Beaufort, 34°34'N, 76°25'W, 19 m, fine sand and shell, BST 88R, coll., J. H. Day, 1965, 3 specimens (USNM 51234).—FLORIDA EAST COAST: Hutchinson Is., sta II, 27°21.6'N, 80°13.2'W, 11 m, coarse calcareous sand, 1 specimen (USNM 54719). Same, sta IV, 27°20.7'N, 80°12.8'W, 11 m, coarse calcareous sand, 2 specimens (FSBC I 27702, 27703). Same, sta V, 27°22.9'N, 80°13.9'W, 11 m, coarse calcareous sand, 13 specimens (USNM 54720; FSBC I 27704, 27709). About 27 km ENE of Ft. Pierce Inlet, 27°33.2'N, 80°03.2'W, 33 m, sand and shell, R/V *Johnson*, coll., R. Virnstein, 14 Jul 1977, 27 specimens (IRCZM 50:893; FSBC I 27709).—FLORIDA WEST COAST: National Marine Fisheries Service, Tampa Bay Area Study, coll., J. Taylor and C. Saloman, 1963, sand bottom, Tampa Bay, 6 specimens (USNM 45691). Same, Terra Ceia Bay, 27°34'24"N, 82°33'55"W, 2 m, algae cover, 6 specimens (ZMC). Same, 27°33'17"N, 82°36'05"W, 2 m, algae cover, 2 specimens (FSBC I 13423). Same, 27°31'36"N, 82°36'18"W, 2 m, algae cover, 13 specimens (FSBC I 13460). Same, Lower Tampa Bay, 27°31'43"N, 82°38'43"W, 5 m, algae cover, 1 specimen (FSBC I 12980).

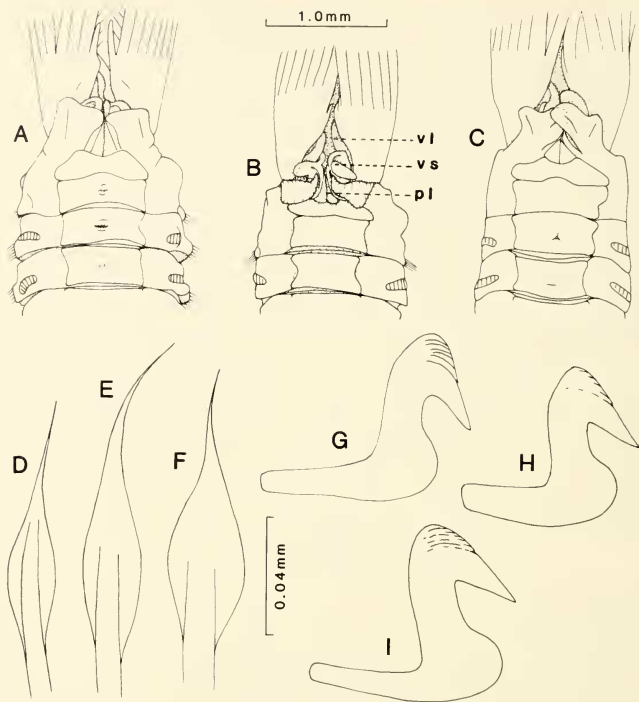


Fig. 41. *Megalomma pigmentum*: A, Anterior end of body and part of branchial crown, ventral view, Tampa Bay, Florida, specimen; B, Same, ventral lappets of collar turned back showing ventral sacs; C, Same, specimen from Venezuela; D-F, Lower thoracic setae (D, Upper seta, anterior row; E, Lower, anterior row; F, Upper, posterior row); G-I, Thoracic avicular hooks (A, B, USNM 45691; C, USNM 57945; D-F, I, FSBC I 12341; G, FSBC I 13395; H, FSBC I 13497).

Same, 27°31'41"N, 82°42'10"W, 3 m, 1 specimen (FSBC I 13145). Same, Boca Ciega Bay, 27°41'58"N, 82°40'18"W, 4 m, 8 specimens (BMNH ZB 1981.214-221). Same, 27°41'13"N, 82°39'51"W, 3 m, 3 specimens (FSBC I 12366). Same, 27°41'37"N, 82°42'01"W, 3 m, 5 specimens (FSBC I 12585). Same, 27°44'09"N, 82°43'55"W, 2 m, 3 specimens (ZMH P-16750). Same, 27°43'27"N, 82°43'24"W, 2 m, 8 specimens (FSBC I 12527). Same, 27°43'08"N, 82°43'07"W, 3 m, 1 specimen (FSBC I 12547). Same, 27°39'19"N, 82°42'10"W, 4 m, 1 specimen (FSBC I 12787). Same, 27°43'56"N, 82°41'40"W, 2 m, 1 specimen (FSBC I 13481). Same, 27°44'12"N, 82°43'22"W, 3 m, 4 specimens (FSBC I 13497). Same, 27°37'33"N, 82°43'43"W, 2 m, algae, *Halodule* and *Thalassia* cover, 1 specimen

(FSBC I 13510). Same, 27°46'49"N, 82°45'53"W, 5 m, 1 specimen (FSBC I 13323). Same, mouth of Long Bayou, Pinellas County, 27°48'17"N, 82°45'53"W, algae cover, sta PB 1, 1 specimen (IRCZM 50:470).—VENEZUELA: Cumaná, 6–10 m, calcareous sand, coll., R. Edwards, 17 Jan 1971, 7 specimens (USNM 57945).

Description.—Maximum length 46 mm, including 8 mm branchial crown; 8 thoracic and about 60 abdominal setigers. Some Atlantic specimens with up to 3 purple crossbands on branchial crown, including one on fused proximal portion; some specimens with large dark brown spots on dorsum medial to notosetae and on ventrum between tori and ventral shields of first few segments; types from western Mexico more highly colored (Reish 1963). Branchial lobes with up to 15 pairs of radioles; only dorsalmost pair with subdistal eyes, greatly enlarged; tips of oculate radioles exceeding eyes only slightly. Collar beginning dorsally medial to setae near posterior margin of collar segment about half distance to midline, extending diagonally to lateral sides; lateral sides almost straight, ending ventrally in bilobed lappets (Fig. 41A, C). Ventral sacs or vesiculate lobes between collar and branchial lobes well developed, joined ventrally to lamellae originating immediately anterior to ventral shield of collar segment lateral to paired, triangular medial lobes and joined dorsally to ventral lips of branchial crown. Ventral shield of collar segment divided into 2 unequal parts by transverse groove (Fig. 41A–C); other thoracic ventral shields about as wide as posterior part of ventral shield of collar, concave laterally. Lower thoracic setae nearly spatulate (Fig. 41D–F); avicular hooks with moderately long handles (Fig. 41G–I); thoracic tori well separated from ventral shields.

Remarks.—The only difference that I could discover between the type-specimens and those from Atlantic areas is that the type-specimens are more highly colored; I do not consider this difference to be important.

The species is known from southern California (Reish 1963), western Mexico, North Carolina, both Florida coasts, and Venezuela in depths to about 30 m.

Megalomma heterops, new species

Figs. 42, 43

Megalomma lobiferum.—Taylor, 1971:717–719.—Hall and Saloman, 1975:19 [not *Branchiomma lobiferum* Ehlers, 1887].

Material examined.—FLORIDA EAST COAST: Hutchinson Is., sta IV, 27°20.7'N, 80°12.8'W, 11 m, coarse calcareous sand, holotype (coll., R. Gallagher, Sep 1971; USNM 54721), paratype (FSBC I 27696), 1 specimen. (FSBC I 27697). Same, sta II, 27°21.6'N, 80°13.2'W, 11 m, coarse calcareous sand, paratype (FSBC I 27698). Same, sta V, 27°22.9'N, 80°13.9'W, 11 m, coarse calcareous sand, paratype (USNM 54722). Off St. Lucie Inlet, Martin County, on coral, *Oculina varicosa* Lesueur, 27°11.2'N, 80°01.0'W, 42 m R/V *Johnson*, JSL II (submersible) 144A, coll., F. Stanton, 26 Oct 1976, 1 specimen (IRCZM 50:894). Same, 27°10.7'N, 80°01.0'W, 43 m, JSL II 147A, 27 Oct 1976, 1 specimen (IRCZM 50:849). Same, 27°10.8'N, 80°00.8'W, 44 m, JSL II 161B, 3 Feb 1977, paratype (IRCZM 50:825). Same, 27°32.8'N, 79°58.8'W, 81 m, JSL I 438A, coll., L. Edmiston, 23 Aug 1977, 1 specimen (IRCZM 50:892).—FLORIDA WEST COAST: N. of Tortugas, 25°33'N, 82°55'W, 47 m, sand, Capetown dredge, coll., T. Cuba, 1979, 1 specimen (Univ. South Florida., St. Petersburg). Same, 25°47'N, 82°55'W, 43 m, sand and

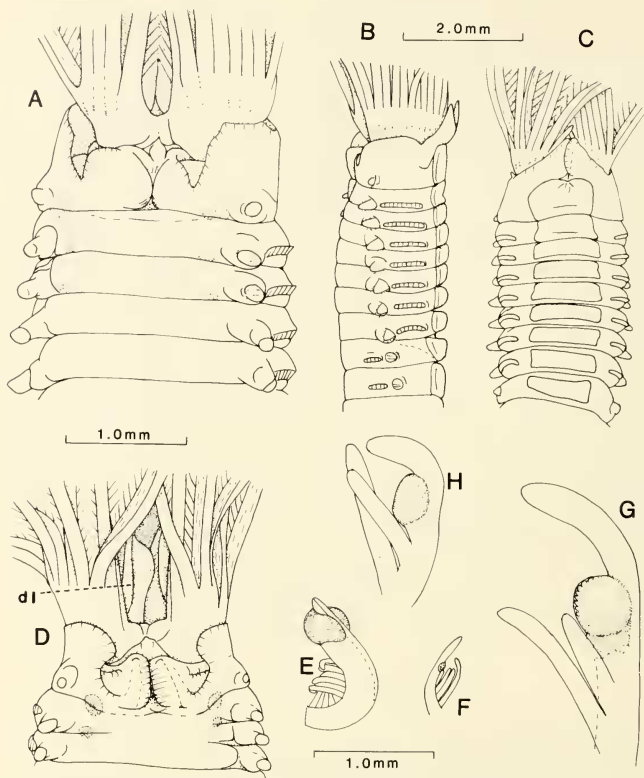


Fig. 42. *Megalomma heterops*: A, Anterior end of body and part of branchial crown, dorsal view; B, Same, lateral view; C, Same, ventral view; D, Same, dorsal view of paratype with dorsomedial parts of collar lamellae not developed; E, Large eye on tip of dorsalmost radiole; F-H, Small eyes on tips of lateral radioles (A-C, E-H, Holotype; D, ZMC; G, H, Not scaled).

shell hash, 1 paratype (FSBC I 27699). Hourglass sta J, 20 nmi W. of Sanibel Is., 26°24'N, 82°28'W, 18 m, algae, living coral, shell and sponge bottom, on coral, *Solenastrea*, dredged, R/V *Hernan Cortez*, coll., B. Presley, 12 Nov 1965, 2 paratypes (BMNH ZB 1981.212-213). Same, 11 May 1966, 5 paratypes (USNM 67953). Same, 5 Jul 1967, paratype (FSBC I 27700). Same, sta C, 26 nmi W. of Egmont Key, Tampa Bay, 27°37'N, 83°28'W, 37 m, sand and *Halodule* bottom, on coral *Solenastrea*, trynet, 31 Aug 1966, 1 specimen (FSBC I 27701). National

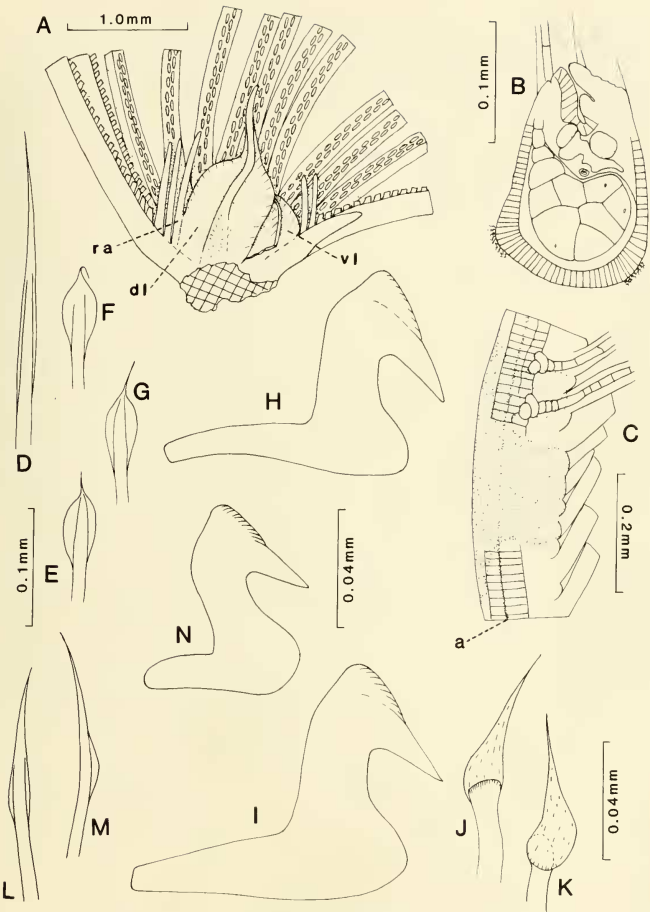


Fig. 43. *Megalomma heterops*: A, Left half of branchial crown, proximal part, medial view; B, Cross section of radiole; C, Part of radiole showing pigment spot, lateral view (a, ciliary row); D, Upper thoracic seta; E-G, Lower thoracic setae (E, Middle, anterior row; F, Upper, posterior row; G, Lower, posterior row); H, I, Thoracic avicular hooks; J, K, Companion setae, opposite views; L, M, Abdominal setae; N, Abdominal avicular hook (A-C, K, FSBC I 27700; D-G, H, J, L-N, Holotype; I, USNM 67953).

Marine Fisheries Service Tampa Bay Area Study, coll., J. Taylor and C. Saloman, 1963–1964, sta PB 1, Boca Ciega Bay, 27°48'17"N, 82°45'53"W, 2 m, sand, algae cover, 2 paratypes (ZMH P-16749). Crystal River, off Florida Power Corporation nuclear power plant, Citrus County, 28°56'24"N, 82°48'30"W, 3 m, 1 paratype (ZMC). Florida Middle Ground, BLM Cr. 01, sta 151, 28°32'02"N, 84°18'36"W, 25–27 m, on coral, *Madracis detactis* (Lyman), coll., T. Hopkins *et al.*, 5 Oct 1978, 3 specimens (USNM 67955). NE Gulf of Mexico, Proj. EGMEX 70, sta 4, 29°07'N, 85°20'W, 36 m, R/V *Hernan Cortez*, coll., J. Williams *et al.*, 5 May 1970, 9 specimens (USNM 67954). Seahorse Key, Cedar Keys, Levy County, on sponge, coll., J. Taylor, 13 May 1960, 2 specimens (USNM 65907). Same, S. shore, coll., J. Taylor, 8 Sep 1960, 1 specimen (USNM 65912). Same, on sponge, coll., T. Hopkins, Sep 1960, 2 specimens (USNM 65910). Whistle buoy area near Alligator Harbor, on sponge, coll., M. Forbes, 2 Jul 1958, 1 paratype (USNM 50480).

Description.—Tube formed of small silicate sand grains in a more or less rigid, translucent matrix, often with large pieces of shell on outside. Body up to 23 mm long, 1.8 mm wide; thorax of 8 setigers; up to 4 mm long; maximum of 70 abdominal setigers; branchial crown up to 8 mm long, with row of elongate pigment spots on fused portion below beginning of radioles (Fig. 42A–D), 4–5 narrow, transverse, purple bands on radioles; bands formed of short pigmented areas on outer and lateral surfaces of radioles, pigment not extending onto pinnules (Fig. 43C), dorsal lips often pigmented on upper surface (Fig. 43A); subterminal eyes also purple but often slightly darker. Body color pattern consisting of paired, purple spots dorsally on anterior margin of collar segment below collar, paired spots on setigers 1–3 medial to notopodia (Fig. 42A, D); some specimens with similar paired spots ventrally on anterior segments and small pigment spots below thoracic and above abdominal tori on posterior thoracic and abdominal segments; pygidium with irregularly arranged eyespots. Radioles 13–16 pairs on specimens with body greater than 15 mm long; radiolar eyes of 2 types, first on dorsalmost pair, greatly enlarged with distinct ommatidia, others much smaller, gradually decreasing ventrally, with smooth surface and ommatidia visible only under high magnification (Fig. 42E–H); dorsalmost radioles greatly enlarged subdistally, with short tips extending past eyes; other radioles not enlarged subdistally, with moderately long, slender tips extending beyond eyes. Proximal cross sections of radioles with 7–8 irregularly arranged skeletal cells surrounded by moderately thick sheath and columnar epithelium (Fig. 43B). Dorsal lips (Figs. 42D; 43A) with moderately long radiolar appendage forming midrib; broad lamellae above and below on proximal $\frac{2}{3}$ of midrib, upper lamellae fused proximally with modified pinnule (pinnular appendage) of first dorsal radiole; 2–3 enlarged pinnules adjacent to pinnular appendage, gradually diminishing. Ventral lips beginning between ventral lappets of collar on anterior margin of collar segment, extending anteriorly and dorsally to dorsal lips, turning ventrally and joining branchial lobes proximally at ventral margin (Fig. 43A); ventral sacs absent. Branchial lobes essentially without palmate membrane; cartilaginous (fused) base short, extending well past collar margin dorsally and laterally. Collar bilobed, beginning dorsally on most larger specimens near midline slightly back from margin of collar segment, margin angled backward forming “V,” extending well past beginning of branchial lobes medial

to collar setae, entire but with slight indentation laterally, ending ventrally in elongate, rounded, triangular lappets extending well past origins of radioles (Fig. 42A–D); dorsomedial parts of collar lamellae not produced on most specimens (Fig. 42D). Ventral shield of collar segment entire, with rounded anterolateral corners and slight anteromedial indentation, twice longer than on other thoracic segments and about as wide. Other thoracic ventral shields rectangular. Notopodia of setigers 2–8 with upper arc of about 5 slender, narrowly hooded setae (Fig. 43D) above two transverse rows of short, subspatulate, broadly hooded setae (Fig. 43E–G), about 10 setae, all similar, in each row. Thoracic tori well separated from ventral shields, gradually shorter posteriorly but of similar distance from shields (Fig. 42B, C), with about 30 pairs of avicular hooks and companion setae anteriorly (Fig. 43H–K); avicular hooks with moderately long, slender handles. Abdominal setae geniculate, hooded (Fig. 43L, M); abdominal avicular hooks in short tori, similar to those of thorax but with shorter handles (Fig. 43N).

Remarks.—*Megalomma heterops* is very similar to the holotype of *M. circum-spectum* (*Branchiomma circumspectum* Moore, 1923:239–241, pl. 18, figs. 41, 42). The collar of *M. circumspectum* has dorsomedial parts which extend well past the anterior margin of the collar segment, and dorsolateral parts are only slightly incised, thus forming deep pockets which extend back to the anterior margin of setiger 2. Also, facets on eyes of lateral radioles are visible under a dissecting microscope (e.g., without compound magnification). The collar of *M. heterops* has dorsomedian parts which extend almost to the anterior margin of the collar segment and is deeply incised dorsolaterally, and facets are not visible on lateral radiolar eyes under a dissecting microscope.

There are two additional forms similar to *M. heterops* from North Carolina, Florida and Venezuela (USNM 53976, 53977, 57946; FSBC I 27710; catalogued as *Megalomma* sp. A) and Puerto Rico (USNM 42791, 53233, 53234, FSBC I 27712; catalogued as *Megalomma* sp. C). Both forms have eyes reduced to flat, pigmented regions on the second and very small, rounded regions on the third dorsal pairs of radioles, and all eyes, except possibly those on second and third dorsal pairs of radioles, as observed under low magnification are faceted. The form from North Carolina, Florida, and Venezuela has more slender lower thoracic setae than those of *M. heterops*, whereas such setae on the form from Puerto Rico are similar to those of *M. heterops*. The two forms are not described at this time because of inadequate material.

Etymology.—The specific name is derived from the Greek *heteros*, meaning different, and *ops*, meaning eye, and refers to the small eyes on the tips of most radioles.

Literature Cited

- Andrews, E. A. 1891. Report upon the Annelida Polychaeta of Beaufort, North Carolina.—Proceedings of the United States National Museum 14(852):277–302, Pls. 12–18.
- Augener, H. 1914. Polychaeta II, Sedentaria. Die Fauna Südwest-Australiens. Ergebnisse der Hamburger südwest-australischen Forschungsreise 1905, herausgegeben von Prof. Dr. W. Michaelsen und Dr. K. Hartmeyer, Band V, Lieferung 1, pp. 1–170, Pl. 1.
- . 1918. Polychaeta. In Michaelsen, W. (ed.).—Beiträge zur Kenntnis Meeresfauna West-Afrikas 2(2):67–625, Pls. 2–7.

- . 1924. Ueber litorale Polychaeten von Westindien.—Sitzungsberichte der Gesellschaft Naturforscher Freunde zu Berlin Vol. for 1922:38–63.
- . 1927. Bijdragen tot de Kennis der Fauna van Curaçao. Resultaten eener Reis van Dr. C. J. van der Horst in 1920. Polychaeten von Curaçao.—K. Zoologisch Genootschap "Natura artis magistra," Amsterdam 25:39–82.
- . 1934. Polychaeten aus den zoologischen Museen von Leiden und Amsterdam. IV.—Zoologische Mededeelingen (Leiden) 17:67–160.
- Baird, W. 1865. On new tubicolous annelids, in the collection of the British Museum. Part 2.—Journal of the Linnaean Society of London, Zoology 8:157–169, Pl. 5.
- Banse, K. 1979. Sabellidae (Polychaeta) principally from the northeast Pacific Ocean.—Journal of the Fisheries Research Board of Canada 36(8):869–882.
- , and K. D. Hobson. 1968. Benthic polychaetes from Puget Sound, Washington, with remarks on four other species.—Proceedings of the United States National Museum 125(3667):1–53.
- Bellan, G. 1963. Campagne de la Calypso dans l'Atlantique, annélides polychètes.—Annales de l'Institut Océanographique de Monaco 41:301–314.
- . 1964. Contribution à l'étude systématique, bionomique et écologique des annélides polychètes de la Méditerranée.—Recueil des Travaux de la Station Marine d'Endoume, Faculté des Sciences de Marseille 49(33), 371 pp.
- Berkeley, E., and C. Berkeley. 1952. Annelida. Polychaeta Sedentaria.—Canadian Pacific Fauna 9b(2), 139 pp.
- . 1954. Additions to the polychaete fauna of Canada, with comments on some older records.—Journal of the Fisheries Research Board of Canada 11(4):454–471.
- . 1961. Notes on Polychaeta from California to Peru.—Canadian Journal of Zoology 39:655–664.
- Bruguière, L. G. 1789. Encyclopédie méthodique. Histoire naturelle des Vers, Vol. 1. Paris, Panckouche and Liege, Plomteux. A. Bul, pp. 1–344.
- Bush, K. J. 1905. Tubicolous annelids of the tribes Sabellides and Serpulides from the Pacific Ocean.—Harriman Alaska Expedition, New York 12:167–347, Pls. 21–44.
- Chamberlin, R. V. 1919. The Annelida Polychaeta.—Memoirs of the Museum of Comparative Zoölogy, Harvard University 48:1–514, 80 Pls.
- Claparède, E. 1869. Les Annélides Chétopodes du Golfe de Naples. Seconde Partie.—Mémoires de la Société de Physique et d'Histoire Naturelle de Genève 20(1):1–225, Pls. 17–31.
- Dauer, D. M. 1973. Polychaete fauna associated with Gulf of Mexico sponges.—Florida Scientist 36(2–4):192–196.
- Day, J. H. 1967. A monograph on the Polychaeta of Southern Africa. Part 2. Sedentaria.—British Museum (Natural History), London, Publication 656; xvii + pp. 459–878.
- . 1973. New Polychaeta from Beaufort, with a key to all species recorded from North Carolina.—National Oceanic and Atmospheric Administration Technical Report, National Marine Fisheries Service Circular 375, 140 pp.
- Ehlers, E. 1887. Report on the Annelids. Florida-Anneliden. Reports on the results of dredging, under the direction of L. F. Pourtales, during the years 1868–1870, and of Alexander Agassiz, in the Gulf of Mexico (1877–78), and in the Caribbean Sea (1878–79), in the U.S. Coast Survey steamer *Blake*, Lieut. Com. C. D. Sigsbee, U.S.N., and Commander J. R. Bartlett, U.S.N., Commanding. No. 31.—Memoirs of the Museum of Comparative Zoölogy, Harvard University 15: vi + 335 pp., 60 Pls.
- Eliason, A. 1951. Polychaeta.—Reports of the Swedish Deep-Sea Expedition 1947–48, Vol. 2, Zoology, No. 11., pp. 131–148, pls. 1, 2.
- Fauchald, K. 1977a. The polychaete worms. Definitions and keys to the orders, families and genera.—Natural History Museum of Los Angeles County Science Series 28, 190 pp.
- . 1977b. Polychaetes from intertidal areas in Panama, with a review of previous shallow-water records.—Smithsonian Contributions to Zoology 221, 81 pp.
- Fauvel, P. 1914a. Annélides polychètes non pélagiques provenant des campagnes de l'*Hirondelle* et de la *Princesse-Alice* (1885–1910).—Résultats des campagnes scientifiques accomplies par le Prince Albert I., Monaco 46, 432 pp., 31 pls.
- . 1914b. Annélides polychètes de San Thomé (Golfe de Guinée) recueillies Par M. Ch. Gravier.—Archives de Zoologie Expérimentale et Générale, Paris 54(5):105–155, pls. 7, 8.
- . 1927. Polychètes sédentaires. Addenda aux Errantes, Archiannelides, Myzostomaires.—Faune de France 16, 494 pp.

- . 1939. Annelida Polychaeta. Résultats scientifiques des croisières du Navire-École Belge *Mercator* 2(1).—Mémoires du Musée d'Histoire Naturelle de Belgique, Bruxelles, Ser. 2. Fasc. 15:3–37.
- . 1953. Annélides polychètes de la croisière du *Président Théodore Tissier* aux Antilles (1951).—Bulletin de l'Institut Océanographique (Monaco) (1033):1–23.
- Gallagher, R. M. 1977. Nearshore marine ecology at Hutchinson Island, Florida: 1971–1974. II. Sediments.—Florida Marine Research Publications No. 23:6–24.
- , and M. L. Hollinger. 1977. Nearshore marine ecology at Hutchinson Island, Florida: 1971–1974. I. Introduction and rationale.—Florida Marine Research Publications No. 23:1–5.
- Gmelin, J. F. 1791. Systema naturae. Thirteenth Edition.—Vol. 1, Pt. 6:3021–3910, Leipzig.
- Gravier, C. 1906a. Sur les Annélides polychètes de la Mer Rouge (Sabellides).—Bulletin du Muséum d'Histoire Naturelle, Paris 12:33–43.
- . 1906b. Contribution à l'étude des Annélides polychètes de la Mer Rouge.—Nouvelles Archives du Muséum d'Histoire Naturelle, Paris (4)8:123–235, pls. 1–8.
- . 1908. Contribution à l'étude des Annélides polychètes de la Mer Rouge (suite).—Nouvelles Archives du Muséum d'Histoire Naturelle, Paris (4)10:67–178.
- Grube, A.-E. 1858. Annulata Oerstediana. Enumeratio Annulorum, quae in itinere per Indian occidentalem et Americam centalem annis 1845–1848 suscepto legit cl. A. S. Oersted, adjectis speciebus nonnullis a cl. H. Krøyer in itinere ad Americam meridionalem collectis. Pt. 3.—Videnskabelige Meddelelser fra den Naturhistoriske Forening i København, pp. 105–120.
- . 1863. Beschreibung neuer oder wenig bekannter Anneliden.—Archiv für Naturgeschichte, Berlin 29:37–59, pls. 4–6.
- . 1868. Beschreibungen einiger von Georg Ritter von Frauenfeld gesammelter Anneliden und Gephyreen des Rothen Meeres.—Verhandlungen der K. K. Zoologisch-Botanische Gesellschaft in Wien 18:629–650, pls. 7, 8.
- . 1870. Bemerkungen über Anneliden des Pariser Museum.—Archiv für Naturgeschichte, Berlin 36.1:281–352.
- . 1874. Descriptiones Annulorum novorum mare Ceylonicum habitantium ab honoratissime Holdsworth collectorum.—Proceedings of the Zoological Society of London (1874):325–329.
- . 1877. Anneliden-Ausbente S.M.S. *Gazella*.—Monatsberichte der Königlich-Preussischer Akademie der Wissenschaften zu Berlin, pp. 509–554.
- . 1878. Annulata Semperiana. Beiträge zur Kenntniss der Annelidenfauna der Philippinen nach den von Herren Prof. Semper mitgebrachten Sammlungen.—Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg, VIIe Série, Vol. 25, No. 8, ix + 300 pp., 15 pls.
- Hall, J. R., and C. H. Saloman. 1975. Distribution and abundance of macroinvertebrate species of six phyla in Tampa Bay, Florida, 1963–64 and 1969.—National Marine Fisheries Service Data Report No. 100, 505 pp.
- Hartman, O. 1938. Annotated list of the types of polychaetous annelids in the Museum of Comparative Zoology.—Bulletin of the Museum of Comparative Zoology, Harvard University 85(1): 1–31, pls. 1–3.
- . 1942a. A review of the types of polychaetous annelids at the Peabody Museum of Natural History, Yale University.—Bulletin of the Bingham Oceanographic Collection, Yale University 8(1):1–98.
- . 1942b. The identity of some marine annelid worms in the United States National Museum.—Proceedings of the United States National Museum 93(3142):101–140.
- . 1944. Polychaetous annelids from California including the descriptions of two new genera and nine new species.—Allan Hancock Pacific Expeditions 10(2):239–307.
- . 1945. The marine annelids of North Carolina.—Bulletin of the Duke University Marine Station 2:1–54.
- . 1951. The littoral marine annelids of the Gulf of Mexico.—Publications of the Institute of Marine Science, University of Texas 2:7–124.
- . 1956. Polychaetous annelids erected by Treadwell, 1891 to 1948, together with a brief chronology.—Bulletin of the American Museum of Natural History 109(2):239–310, pl. 21.
- . 1959. Catalogue of the polychaetous annelids of the world, parts 1 and 2.—Allan Hancock Foundation Publications Occasional Paper 23:1–628.
- . 1961. Polychaetous annelids from California.—Allan Hancock Pacific Expeditions 25:1–226.

- . 1965a. Catalogue of the polychaetous annelids of the world. Supplement 1960–1965 and index.—Allan Hancock Foundation Publications Occasional Paper 23:1–197.
- . 1965b. Deep-water benthic polychaetous annelids of New England to Bermuda and other North Atlantic areas.—Allan Hancock Foundation Publications Occasional Paper 28:1–378.
- . 1966. Polychaetous annelids of the Hawaiian Islands.—Occasional Papers Bernice P. Bishop Museum 23(11):163–252.
- . 1969. Atlas of the sedentariate polychaetous annelids from California.—Allan Hancock Foundation, University of Southern California, Los Angeles, 812 pp.
- Hartmann-Schröder, G. 1971. Annelida, Borstenwürmer, Polychaeta.—Die Tierwelt Deutschlands 58, 594 pp.
- Haswell, W. A. 1884. The marine annelids of the order Serpulea. Some observations on their anatomy, with the characteristics of the Australian species.—Proceedings of the Linnean Society of New South Wales 9:649–675, pls. 31–35.
- Hoagland, R. A. 1919. Polychaetous annelids from Porto Rico, the Florida Keys and Bermuda.—Bulletin of the American Museum of Natural History 41(16):571–591, pls. 29–32.
- . 1920. Polychaetous annelids collected by the United States Fisheries steamer *Albatross* during the Philippine Expeditions of 1907 to 1909.—Bulletin of the United States National Museum 100:603–634, pls. 46–52.
- Hobson, K. D., and K. Banse. 1981. Sedentariate and archiannelid polychaetes of British Columbia and Washington.—Canadian Bulletin of Fisheries and Aquatic Sciences No. 209, viii + 144 pp.
- Imajima, M., and O. Hartman. 1964. The polychaetous annelids of Japan.—Allan Hancock Foundation Publications Occasional Paper 26, 452 pp.
- International Code of Zoological Nomenclature Adopted by the XV International Congress of Zoology, 1961. Second Edition, 1964.—London, International Trust for Zoological Nomenclature, xix + 176 pp.
- Iroso, I. 1921. Revisione dei Serulidi e Sabellidi del Golfo di Napoli.—Pubblicazioni della Stazione Zoologica di Napoli 3:47–91, pls. 3, 4.
- Johansson, K. E. 1925. Bemerkungen über die Kinberg'schen Arten der Familien Hermellidae und Sabellidae.—Arkiv for Zoologi 18A(7):1–28.
- . 1927. Beiträge zur Kenntnis der Polychaeten-Familien Hermellidae, Sabellidae und Serpulidae.—Zoologiska Bidrag från Uppsala 11:1–184, 5 pls.
- Kerby, C. J. 1972. The biology of *Sabella microphthalma* (Polychaeta).—Ph.D. Dissertation, George Washington University, Washington, D.C., iv + 273 pp., 176 Figs.
- Kinberg, J. G. H. 1867. Annulata nova.—Öfversigt af (Svenska) Vetenskapsakademien Forhandlingar, Stockholm, 23:337–357.
- . 1910. Konglia Svenska Fregatten *Eugenies* Resa Omkring jorden under befäl af C. A. Virgin åren 1851–1853. Vetenskapliga Iakttagelser på H. Mag:t Konung Oscar den Förstes befallning utgifna af K. Svenska Vetenskaps-akademien, Zoologi VII. Annulater.—Uppsala and Stockholm, Almqvist and Wicksells. pp. 33–78, pls. 9–29 [second part; published posthumously].
- Kölliker, A. 1858. Ueber Kopfkriemer mit Augen an Kiemen (Branchiomma dalyelli).—Zeitschrift für Wissenschaftliche Zoologie, Leipzig 9:536–541.
- Knight-Jones, P. 1981. Behavior, setal inversion and phylogeny of Sabellida (Polychaeta).—Zoologica Scripta 10:183–202.
- . 1983. Contributions to the taxonomy of Sabellidae (Polychaeta).—Zoological Journal of the Linnean Society 79:245–295.
- Krøyer, K. 1856. . . . Meddelelser . . . om Ormeslaegten *Sabella* Linn., isaer dans nordiske Arter.—Översigt over det Kgl. Danske Videnskabernes Selskabs Forhandlinger, Copenhagen: 1–36.
- Langerhans, P. 1884. Die Wurmfauna von Madeira. IV.—Zeitschrift für Wissenschaftliche Zoologie 40:247–285, pls. 15–17.
- Levinson, G. M. R. 1882–1883. Systematik-geografisk oversigt over de nordiske Annulata, Gephyrea, Chaetognathi, og Balanoglossi.—Videnskabelige Meddelelser fra Dansk Naturhist-Orisk Forening i Kjøbenhavn. Pt. 1, pp. 160–250, pls. 7, 1882; Pt. 2, pp. 92–348, pl. 2–3, 1883.
- . 1893. Annulata. Hydriodae, Anthozoa, Porifera.—Vidensk. Udbytte af Kanonbaaden *Hauchs* Togter, København, pp. 321–364, 1 Pl.
- Linné, C. 1758. Systema naturae. Tenth Edition.
- . 1767. Systema naturae. Twelfth Edition.

- Loi, Tran-ngoc. 1980. Catalogue of the types of polychaete species erected by J. Percy Moore.—Proceedings of the Academy of Natural Sciences of Philadelphia 132:121–149.
- Malmgren, A. J. 1866. Nordiska Hafs-Annulater.—Öfversigt af K. Vetenskapsakademien. Förhandlingar [1865, No. 5] 22:355–410, pls. 18–29.
- Marenzeller, E. 1884. Sudjapanische Anneliden. II.—Denkschriften der Kaiserliche Akademie der Wissenschaften, Mathematische-Naturwissen Klasse, Wien 49:197–224, pls. 1–4.
- Marion, A. F., and N. Bobretzky. 1875. Étude des Annélides du Golfe de Marseille.—Annales des Sciences Naturelles, Paris 2(1):1–106, Pls. 1–12.
- Marsden, J. 1960. Polychaetous annelids from the shallow waters around Barbados and other islands of the West Indies, with notes on larval forms.—Canadian Journal of Zoology 38:989–1020.
- Monro, C. C. A. 1933. The Polychaeta Sedentaria collected by Dr. C. Crossland at Colon in the Panama region and the Galapagos Islands during the expedition of the S. Y. *St. George*.—Proceedings of the Zoological Society of London, Pt. 51(1933):1039–1092.
- Montagu, G. 1804. Descriptions of several marine animals found on the south coast of Devonshire.—Transactions of the Linnaean Society of London 7(7):61–85, pls. 6, 7.
- . 1815. Descriptions of several new or rare animals principally marine, found on the south coast of Devonshire.—Transactions of the Linnean Society of London 11:1–26, pls. 3–5. [not seen].
- Moore, J. P. 1904. New Polychaeta from California.—Proceedings of the Academy of Natural Sciences of Philadelphia 56:484–503, pls. 37, 38.
- . 1909. Polychaetous annelids from Monterey Bay and San Diego, California.—Proceedings of the Academy of Natural Sciences of Philadelphia 61:235–295, pls. 7–9.
- . 1923. The polychaetous annelids dredged by the U.S.S. *Albatross* off the coast of southern California in 1904. IV. Spionidae to Sabelliariidae.—Proceedings of the Academy of Natural Sciences of Philadelphia 65:179–259, pls. 17, 18.
- , and K. J. Bush. 1904. Sabellidae and Serpulidae from Japan, with descriptions of new species of *Spirorbis*.—Proceedings of the Academy of Natural Sciences of Philadelphia 56:157–179, pls. 11, 12.
- Müller, O. F. 1771. Von Würmern des süßen und salzigen Wassers.—Copenhagen, Heinrich Mumme und Faber, 200 pp., 16 pls. [not seen].
- Mullin, C. A. 1923. Report on some polychaetous annelids collected by the Barbados-Antigua Expedition from the University of Iowa in 1918.—University of Iowa Studies in Natural History 10:39–60, pls. 1–7.
- Nonato, E. F., and J. A. C. Luna. 1970. Anelídeos Poliquetas do nordeste do Brasil. I. Poliquetas bentônicos da costa de Alagoas e Sergipe.—Boletim do Instituto Oceanográfico (São Paulo) 19(1):57–130.
- Orrhage, L. 1971. Light and electron microscope studies of annelid setae.—Acta Zoologica 52:157–169.
- . 1980. On the structure and homologues of the anterior end of the polychaeta families Sabellidae and Serpulidae.—Zoomorphology 96:113–168.
- Perkins, T. H. 1979. Lumbrineridae, Arbellidae, and Dorvilleidae (Polychaeta), principally from Florida, with descriptions of six new species.—Proceedings of the Biological Society of Washington 92(3):415–465.
- . 1980. Review of species previously referred to *Ceratonereis mirabilis*, and descriptions of new species of *Ceratonereis*, *Nephytys* and *Goniada* (Polychaeta).—Proceedings of the Biological Society of Washington 93(1):1–49.
- . 1981. Syllidae (Polychaeta), principally from Florida, with descriptions of a new genus and twenty-one new species.—Proceedings of the Biological Society of Washington 93(4):1080–1172.
- , and T. Savage. 1975. A bibliography and checklist of polychaetous annelids of Florida, the Gulf of Mexico, and the Caribbean Region.—Florida Marine Research Publications No. 14, 62 pp.
- Reish, D. J. 1963. A quantitative study of the benthic polychaetous annelids of Bahía de San Quintin, Baja California.—Pacific Naturalist 3(14):399–436.
- Rullier, F., and L. Amoureux. 1979. Campagne de la Calypso au large des cotés Atlantique de l'Amerique du sud (1961–1962). I. Annélides polychètes.—Annales de l'Institut Océanographique 55(suppl.):145–206.

- Saint-Joseph, Baron A. de. 1894. Les Annélides polychètes des côtes de Dinard. Troisième partie.—Annales des Sciences Naturelles, Paris Ser. 7, 17(1):1–395, Pls. 1–13.
- Sars, M. 1850. Beretning om en i Sommeren 1849 foretagen zoologisk Reise i Lofoten og Finmarken.—Nytt Magazin for Naturvidenskaben 6:121–211. [not seen].
- Savigny, J.-S. 1820. Système des Annélides, principalement de celles des côtes de l'Égypte et de la Syrie, offrant les caractères tant distinctifs que naturelles des orders, familles et genres, avec la description des especes.—Description de l'Égypte. Histoire naturelle, Paris, 21:325–472.
- Schmarda, L. K. 1861. Neue wirbellose Thiere beobachtet und gesammelt auf einer Reise um die Erde 1853 bis 1857. Vol. 1. Turbellarien, Rotatorien und Anneliden. Pt. 2:1–164, Pls. 16–37.—Leipzig, Wilhelm Engelmann.
- Smith, R. I. (editor). 1964. Keys to marine invertebrates of the Woods Hole region.—Systematics-Ecology Program, Marine Biological Laboratory, Woods Hole, Massachusetts, 208 pp.
- Spurr, A. R. 1969. A low-viscosity epoxy resin embedding medium for electron microscopy.—Journal of Ultrastructure Research 26:31–43.
- Tauber, P. 1879. Annulata Danica. En kritisk revision af de i Danmark fundne Annulata Chaetognatha, Gephyrea, Balanoglossi, Discophoreae, Oligochaeta, Gymnocolpa og Polychaeta—Kjøbenhavn, Reitzel, 144 pp.
- Taylor, J. L. 1961. Polychaetous annelids of the Seahorse Key area.—M.S. Thesis, University of Florida, Gainesville, iv + 288 pp.
- . 1971. Polychaetous annelids and benthic environments in Tampa Bay, Florida.—Ph.D. Dissertation, University of Florida, Gainesville, 1332 pp.
- Treadwell, A. L. 1901. The polychaetous annelids of Porto Rico.—Bulletin of the United States Fisheries Commission for 1900, 20(2):181–200.
- . 1906. Polychaetous annelids of the Hawaiian Islands, collected by the steamer *Albatross* in 1902.—Bulletin of the United States Fisheries Commission for 1903, 23(3):1145–1181.
- . 1917. Polychaetous annelids from Florida, Porto Rico, Bermuda and Bahamas.—Carnegie Institute of Washington Publication No. 251, Papers of the Tortugas Laboratory 11:257–268, pls. 1–3.
- . 1924. Reports on certain invertebrates and fishes of the Barbados-Antigua Expedition of 1918. Polychaetous annelids.—University of Iowa Studies in Natural History 10(4):1–23, pls. 1, 2.
- . 1939. Polychaetous annelids of Porto Rico and vicinity.—Scientific Survey of Porto Rico and the Virgin Islands, New York Academy of Sciences 16(2):151–319.
- Uschakov, P. V. 1955. [Polychaeta of the far eastern seas of the U.S.S.R.] (in Russian).—Academy of Science of the U.S.S.R. Keys to the fauna of the U.S.S.R. 56:1–433 (translated, Israel Program for Scientific Translations, Jerusalem, 1965).
- Verrill, A. E. 1873. Report upon the invertebrate animals of Vineyard Sound and the adjacent waters, with an account of the physical characters of the region.—Report of the United States Commission of Fish and Fisheries for 1871–1872:295–778.
- Webster, H. E. 1884. Annelida from Bermuda, collected by G. Brown Goode.—Bulletin of the United States National Museum 25:305–327, Pls. 7–12.
- Wells, H. W., and I. E. Gray. 1964. Polychaetous annelids of the Cape Hatteras area.—Journal of the Elisha Mitchell Scientific Society 80(2):70–78.
- Wiktor, J. 1980. Type-specimens of Annelida Polychaeta in the Museum of Natural History of the Wrocław University.—Annales Zoologici 35(20):267–283.
- Wills, J. B., and T. J. Bright. 1974. Worms. In T. J. Bright and L. H. Pequegnat (Eds.), Biota of the West Flower Garden Bank.—Gulf Publishing Co., Houston, Texas. Pp. 291–309.
- Worth, D. F., and M. L. Hollinger. 1977. Nearshore marine ecology at Hutchinson Island, Florida: 1971–1974. III. Physical and chemical environment.—Florida Marine Research Publications No. 23:25–85.

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